FARR

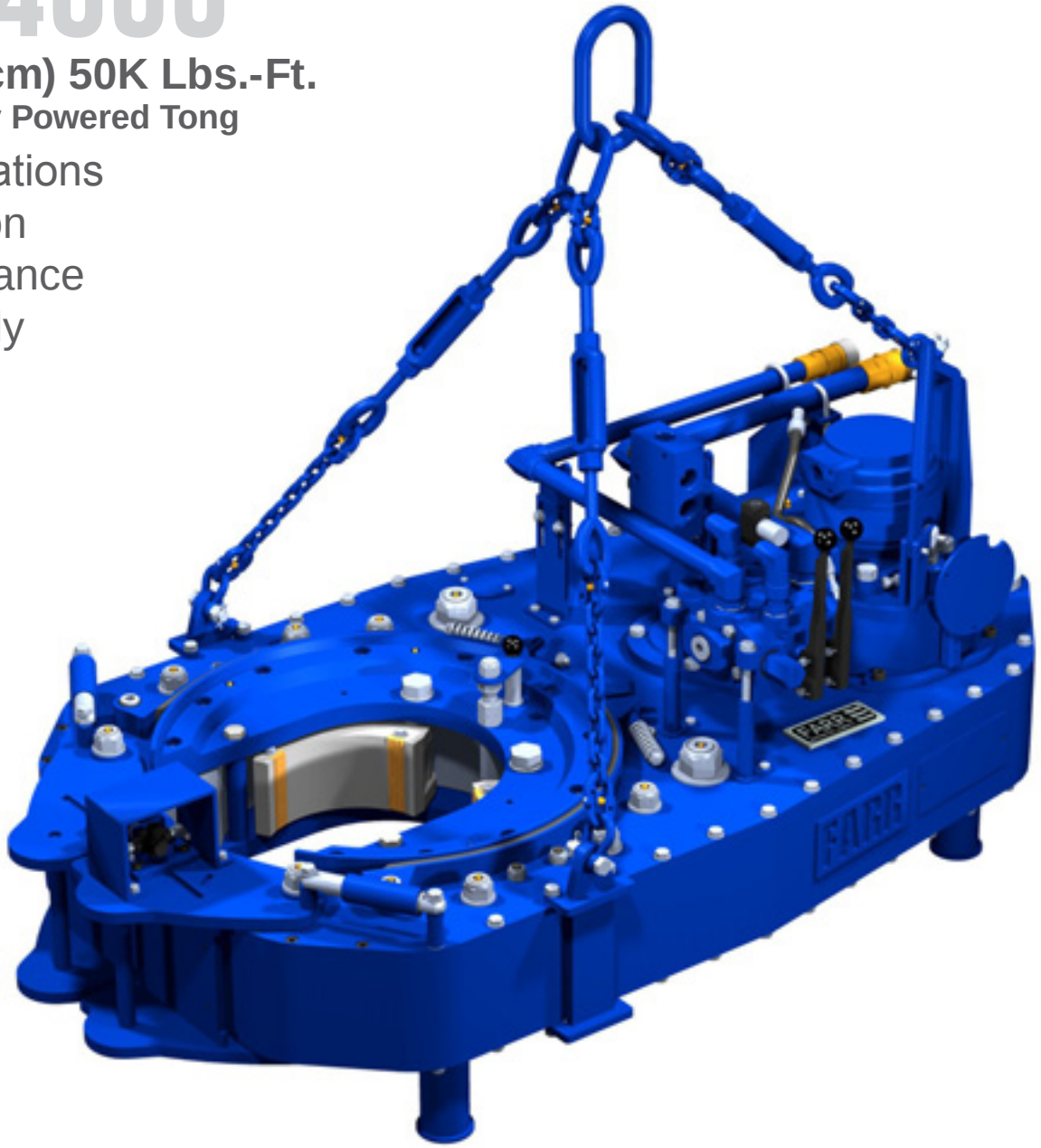
TECHNICAL MANUAL

KT-14000

14” (35.6 cm) 50K Lbs.-Ft.

Hydraulically Powered Tong

- Specifications
- Operation
- Maintenance
- Assembly



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This manual covers the following models:

TONG MODEL	REV	DESCRIPTION
80-1001	**2**	*Tong with Rineer GA37/26 motor & motor valve.*
80-1001-1	**1**	*Tong with Rineer GA37/26 motor, motor valve, lift cylinder valve, & safety door*
80-1001-2		*Tong with Rineer GA37/26 motor, motor valve, lift cylinder valve, safety door & optional dump valve.*
80-1001-3	**1**	*Tong with Rineer GA37/26 motor, motor valve, & lift cylinder valve.*
80-1001-6	**1**	*Tong with Rineer GA37/26 motor, motor valve, lift cylinder valve, & safety door. CLOSED CENTRE.*

NOTE: ***Some illustrations used in this manual may not exactly match your equipment.***

PATENTED & PATENTS PENDING

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WARNINGS

A “LOAD-BEARING DEVICE” IS A CHAIN SLING, RIGID SLING, SPREADER BAR ASSEMBLY, FRAME, OR ANY OTHER DEVICE THAT BEARS THE PARTIAL OR TOTAL WEIGHT OF THE EQUIPMENT FOR WHICH THIS MANUAL HAS BEEN PRODUCED

THE LOAD-BEARING DEVICE SUPPLIED BY FARR CANADA CORP. IS DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL. FARR CANADA CORP. WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES. FARR CANADA CORP. WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO LIFT OR SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL IF THERE ARE ANY MODIFICATIONS TO THE LOAD-BEARING DEVICE, OR ANY ADDITIONS TO THE EQUIPMENT DESCRIBED IN THIS MANUAL THAT ADD WEIGHT TO THE EQUIPMENT, UNLESS SUPPLIED BY FARR CANADA CORP..

WHEN RE-ASSEMBLING LOAD-BEARING DEVICES (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS, ETC.) NOTE THAT THE ASSOCIATED FASTENERS MUST BE TIGHTENED TO THE CORRECT TORQUE SPECIFIED FOR THAT SIZE OF FASTENER (SEE SECTION 3 - OVERHAUL). ANY THREADED FASTENER IN A LOAD-BEARING DEVICE MUST BE SECURED WITH RED OR BLUE LOCTITE™.

ANY REPLACEMENT FASTENER (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) USED DURING MAINTENANCE OR OVERHAUL MUST BE GRADE 8 OR EQUIVALENT UNLESS OTHERWISE SPECIFIED.

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Farr Canada Corp. has made every effort to ensure the information contained in this document is accurate and current. This manual is intended to provide equipment operation and safety instructions for your equipment. However, Farr Canada Corp. does not warrant or guarantee that the information is either complete or accurate in every respect, and the user of the manual shall protect, indemnify, and hold harmless Farr Canada Corp., and all their directors, officers, employees, and agents from and against all liability for personal injury, death, or property damage resulting directly or indirectly from the use of the information contained in this manual.

Observance of all descriptions, information and instructions set out in this manual is the full responsibility of the user. This manual is intended for guidance and informational purposes and must be used in association with adequate training and on-the-job supervision to provide safe and effective equipment use.

It is the responsibility of the user to conform to all regulations and requirements issued by an authority or agency which may affect the operation, safety or equipment integrity, that may overrule the content of this documentation.

The user will acknowledge and obey any general legal or other mandatory regulation in force relating to accident prevention, safety, and equipment integrity.

Summary Of Revisions

Date	Section	Page	Description Of Revision
JULY 2008	N/A	N/A	Intial Release
DEC 2008	7.0	7.47	Added part numbers for items “L” & “M”
AUG 2009	Intro	iii	Added information for model 80-1001-6 (closed centre)
	2.0	All	Moved assembly section to “Maintenance” section (section 3). Re-assigned section numbers.
	2.0	2.1	Added load-bearing device safety
	Appendices		Added tong daily & monthly maintenance checklists, power unit daily maintenance, tong decommissioning & recommissioning checklists
OCT 2009	2.0	2.8	Added Motor Section DVA35 HI BOY 10-0001 to item table (applies only to model 80-1001-6)
JUNE 2011	All	All	Re-branded manual
	Intro	ix	Added Table of Illustrations
	All	All	Improved warnings throughout manual
	2	2.13	Replaced jaw removal and jaw die removal images
	2	2.14	Re-titled Section 2.F.1 “Suspension and Tong Restraint”, and added detailed tie-off instructions.
	2	2.20	Added Section “Making and Breaking Connections”
	3	3.1	Added Section “ Preventive Maintenance Practices”
	3	3.6	Added door spring cylinder lubrication instruction
	3	3.7	Removed “Door Latch Adjustment” references - does not apply to this tong
	3	3.10	Replaced graphic - Shifter Detent Force Adjustment
	3	3.13	Revised Section: “Assembly Procedures”
	3	3.24	Moved maintenance checklists from appendices to Maintenance section
	5	5.2 - 5.3	Replaced gear train layout images to reflect support roller changes
	5	5.2 - 5.3	Replaced gear train layout images to reflect support roller changes
	5	5.4	Updated support roller array image to reflect support roller changes
	5	5.6 - 5.17	Replaced support roller images and bills of material to reflect changes
	6	6.1 - 6.8	Complete revision of torque measurement section

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The information presented in this document will provide setup, operating, and maintenance instructions for your KT-14000 tong. Due to the wide variety of operating conditions, these instructions must be considered guidelines rather than absolute operating procedures. It is the responsibility of the user to use these guidelines together with an experienced manager to develop operating procedures that conform to all policies set forth by the operating authority (ies).

IDENTIFICATION OF WARNINGS AND OTHER NOMENCLATURE OF IMPORTANCE USED IN THIS TECHNICAL MANUAL

Farr Canada Corp. uses three indicators to describe items of three degrees of importance.

*A **HAZARD** to operators or equipment is represented by an exclamation point within a red triangle. identifies items of the highest importance. Failure to heed information identified by a **HAZARD** symbol may result in bodily injury, death, catastrophic equipment damage, or any combination of these. A **HAZARD** may also indicate the potential for dangerous environmental contamination.*

This identifies a HAZARD to operators or equipment

*A **WARNING** is represented by an exclamation point within an orange triangle, and contains information that will alert personnel to a potential safety hazard that is not life-threatening. A **WARNING** may also serve to alert the user to information critical to the correct assembly or operation of the equipment in use.*

This identifies a WARNING to users

*A **CAUTION** is represented by an exclamation point within a yellow triangle and highlights information that may aid the user during assembly or operation of your equipment. CAUTIONs are also used to ensure common errors are not made during assembly or operation of your equipment.*

This identifies a CAUTION to users

Observance of the following is the full responsibility of the user:

- ***all descriptions, information and instructions set out in this manual***
- ***any regulation or requirement issued by an authority or agency which may influence operation, safety or integrity of the equipment that overrules the content of this document.***
- ***any legal or other mandatory regulation in force governing accident prevention or environmental protection.***

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Congratulations on the purchase of your FARR® KT-14000 14” tong. This unit will provide you with years of outstanding performance. Simple maintenance and care will extend its life and ensure years of excellent performance and reliability. The setup, operating, and maintenance instructions in this manual will assist you in giving your equipment the care it requires. Please carefully read the manual before installing and using your equipment. Replacement parts are readily available from McCoy Drilling & Completions | Farr in Edmonton, Alberta. Note that many parts are transferable between FARR® tongs and backups. Should you need replacement parts, or should you experience any difficulty not covered in this manual, please contact:

McCoy Drilling & Completions | Farr

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Edmonton, Alberta
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Phone: 780.453.3277
Fax: 780.455.2432

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Website: http://www.mccoyglobal.com/index.php/drilling-completions

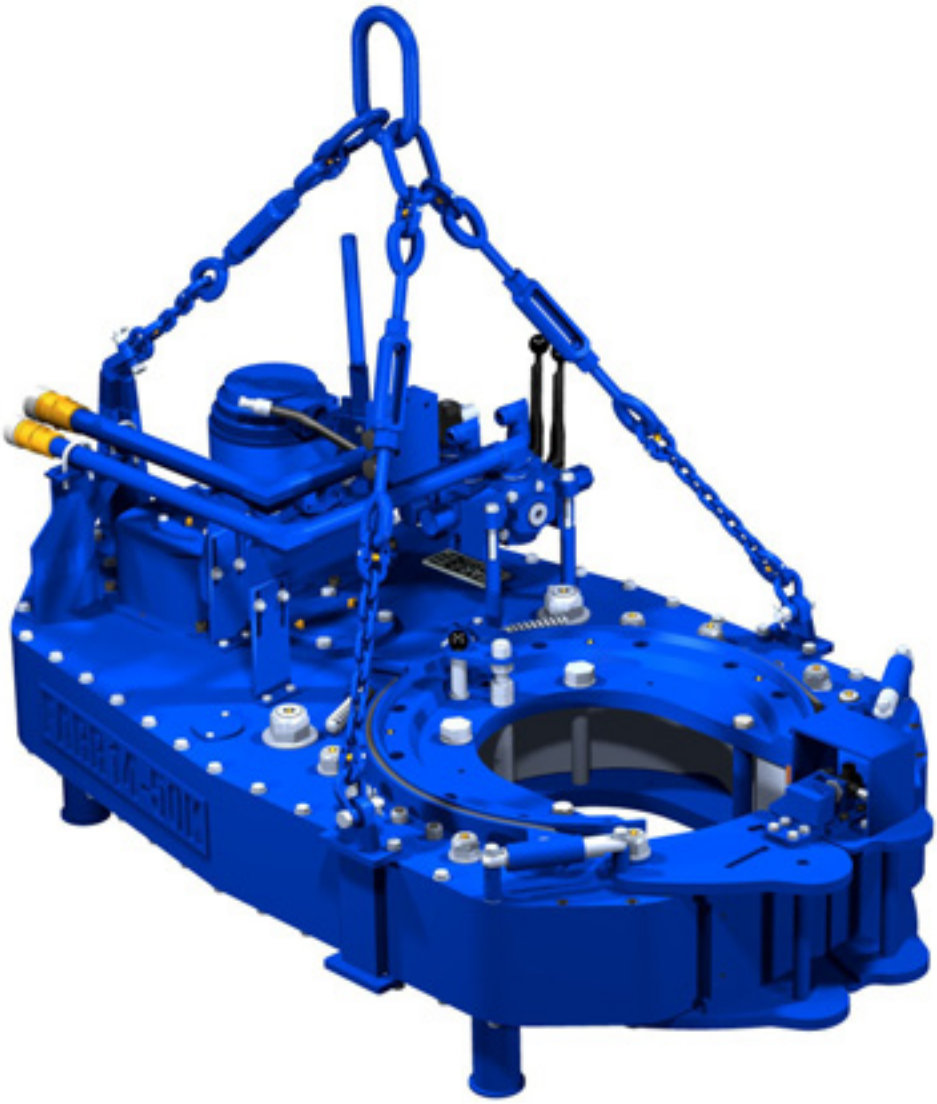

Illustration 1.A.1: KT-14000 Tong

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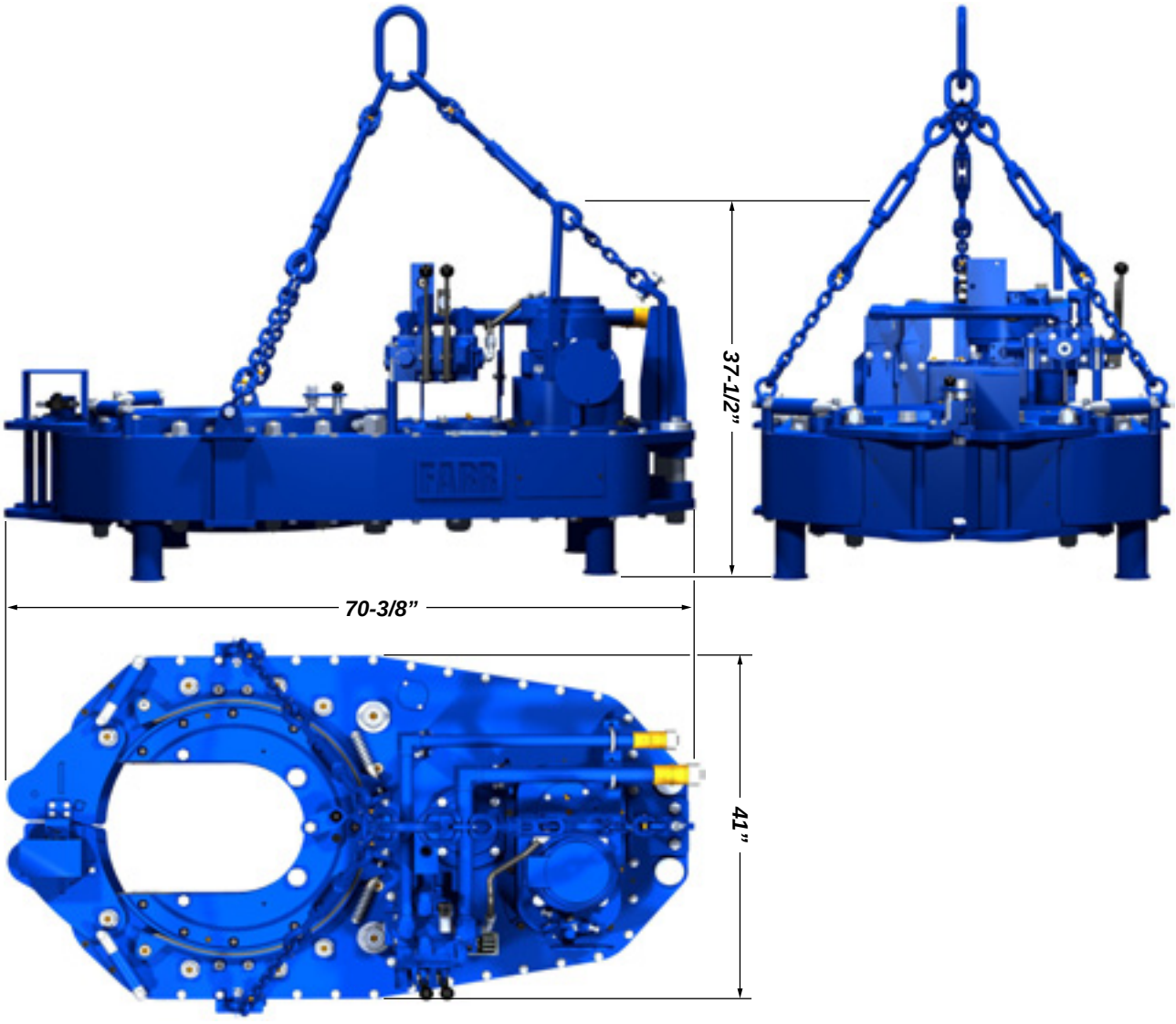

ILLUSTRATION 1.A.2: KT-14000 POWER TONG DIMENSIONS

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Torque Table				
Pressure	High Gear		Low Gear	
PSI / MPa	Lbs.-ft.	Nm	Lbs.-ft.	Nm
1000 / 6.89	4000	5423	16300	22100
1600 / 11.03	7420	10060	30280	41054
2000 / 13.79	9700	13151	39590	53677
2500 / 15.17	12560	17029	51240	69472
MAXIMUM RATED TORQUE: 50000 LBS.-FT. / 67791 Nm				

Speed Table		
Flow (US GPM / LPM)	Low Gear (RPM)	High Gear (RPM)
10 / 37.9	1.0	4.1
20 / 75.71	2.0	8.1
40 / 151.4	4.0	16.2
60 / 227.1	6.0	24.4

Hydraulic Requirements (max.): 60 US GPM @ 1000 psi (227 LPM @ 6.9 MPa) 10 US GPM @ 2200 psi (38 LPM @ 17.2 MPa)

Max Length: 70-3/8” inches / 179 cm

Height: 37-1/2” / 95 cm Tip Of Shifter Shaft To Bottom Of Leg

57” / 145 cm Including Chain Sling

Overall Width: 41” inches / 104 cm

Space Required on Pipe: 10” / 25.4 cm

Torque Arm Length: 45-1/2” inches / 115.6 cm (Centerline of pipe to Centerline of anchor)

Recommended Spring Hanger: 85-0106XXH

Maximum Elevator Diameter: Unlimited (tong comes off pipe)

Weight (Approximate): 3150 lb. / 1432 kg.

Casing Jaws Avilable (inches): See Pg. 2.12

REPLACEMENT FASTENERS (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) MUST BE GRADE 8 OR EQUIVALENT (WHERE REQUIRED).

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Use an EP synthetic grease that meets or exceeds the following specifications:

Thickener	*Lithium Complex*
NLGI consistency grade	*2*
NLGI performance grade	*GC-LB*
Penetration - ASTM D 217 (25°C [77°F] 0.1 mm) worked 60 strokes	*265-295 minimum*
Dropping point, °F[°C] - ASTM D2265	*550 [288] minimum*
High temperature life, hours - ASTM D 3527	*160 minimum*
Oxidation stability, psi - ASTM D 942	*(100 hr/300 hr) 0/3*
Water washout, percent - ASTM D 1264	*1.8 max*
Rust and corrosion - ASTM D 1743	*pass*
Oil separation, percent loss - ASTM D 1742 (24 hours, 25°C [77°F]	*1.1 max*
Leakage, g lost - ASTM D 4290	*1.0 max*
Four ball wear test, mm scar - ASTM D 2266	*0.40 max*
Fretting wear, mg - ASTM D 4170	*3.4 max*
Four ball EP, kgf - ASTM D 2596	
Weld point	*400 minimum*
Load wear index	*50 minimum*
Timken OK load test, lbs - ASTM D 2509	*50*
*Low temperature torque, N*m - ASTM D 4693 (-40°C [-40°F])*	*1.3 max*
LT-37 pumpability, g/min (60°F/0°F [16°C/-18°C])	*360/7*
Copper corrosion - ASTM D 4048	*1B*
Disc brake wheel bearing specifications	
Ford ESA-M1C 198A	*Yes*
Chrysler MS-3701	*Yes*
Oil viscosity: 40°C [104°F], cSt	*151*
100°C [212°F], cSt	*19.2*
Flash point, °F[°C] - ASTM 92	*450[232]*

Use a premium quality hydraulic fluid that meets or exceeds the following specifications:

Typical Density (kg/m3)	*878*
Viscosity - cSt @ 40 °C	*68.8*
- cSt @ 100 °C	*8.7*
Viscosity Index	*97*
Pour Point °F [°C]	*-22 [-30]*
Flash Point °F [°C]	*432 [222]*
Colour, ASTM	*1.5*
Neutralization Number	*0.40*
Rust Protection - Distilled Water	*No Rust*
- Sea Water	*No Rust*
Hydrolytic Stability - Cu Mass Loss, mg/cm2	*0.04*
Copper Corrosion Test	*1A*
Filterability: Denison - Wet & Dry	*Pass*
Afnor - Wet & Dry	*Pass*
Cincinatti Milacron Spec Approved	*P69*
Denison HF-0:	*Approved*
Denison P-46 Piston Pump:	*Pass*
Denison T6C Vane Pump:	*Pass*
Vickers 35VQ25 Vane Pump Test:	*Pass*
104/105C Vane Pump Test:	*No Data Available*
Vane pump test total ring and vane wear, mg.	*<10*
Oxidation Stability	
Turbine Oil Stability Test Life, hours	*2500+*
Rotary Bomb Oxidation Test, minutes	*325*
FZG Spur Gear Test, Failure Load Stage (FLS)	*12*

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Adequate setup and proper hydraulic connections are essential in ensuring reliable operation of your tong. For best results and long term reliability, read and obey the start-up instructions in this section.

DO NOT ACCESS ROTATING COMPONENTS UNLESS HYDRAULIC POWER SUPPLY HAS BEEN DEACTIVATED OR ISOLATED.

A CLEARLY IDENTIFIED REMOTE POWER PACK EMERGENCY STOP MUST BE INSTALLED IN THE IMMEDIATE VICINITY OF THE TONG OPERATOR.

A. SLING / LOAD BEARING DEVICE SAFETY

THE SUPPLIED LOAD-BEARING DEVICE (CHAIN SLING, RIGID SLING, SPREADER BAR ASSEMBLY, FRAME, OR ANY OTHER DEVICE THAT BEARS THE PARTIAL OR TOTAL WEIGHT OF THE EQUIPMENT DESCRIBED IN THIS MANUAL) HAS BEEN SPECIFIED OR DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS DOCUMENT. FARR® WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES, OR ANY ADDITIONS TO THE EQUIPMENT DESCRIBED IN THIS MANUAL THAT ADD WEIGHT TO THE EQUIPMENT, UNLESS SUPPLIED BY MCCOY.

MCCOY DRILLING & COMPLETIONS DOES NOT GUARANTEE THE INTEGRITY OF MODIFIED OR DAMAGED LOAD-BEARING DEVICES, UNLESS THOSE MODIFICATIONS ARE PERFORMED BY MCCOY.

McCoy Drilling & Completions recommends following an industry-accepted standard such as OSHA, ASME B30.9-2006, or manufacturer’s guidelines when performing any rigging and overhead lifting. Use by untrained persons is hazardous. Improper use will result in serious injury or death. Do not exceed rated capacity. Slings will fail if damaged, abused, misused, overused, or improperly maintained.

- *Only grade 80 or grade 100 alloy chain should be used for overhead lifting applications.*
- *Working Load Limit (WLL) is the maximum allowable load in pounds which may be applied to the load-bearing device, when the device is new or in “as new” condition, and when the load is uniformly and directly applied. The WLL must never be exceeded.*
- *Working Load Limit (WLL) is the maximum working load for a specific minimum sling angle, measured from the horizontal plane. The Working Load Limit is identified on the sling.*
- *The Working Load Limit or Design factor may be affected by wear, misuse, overloading, corrosion, deformation, intentional alterations, sharp corner cutting action and other use conditions.*
- *Shock loading and extraordinary conditions must be taken into account when selecting alloy chain slings.*
- *See OSHA Regulation for Slings 1910.184, ANSI/ASME B30.9-”SLINGS”, ANSI/ASME B30.10-”HOOKS” and ANSI/AMSE B30.26 “RIGGING HARDWARE” for additional information.*

THE MINIMUM SLING ANGLE (THE ANGLE OF THE LEG OF THE SLING MEASURED FROM THE HORIZONTAL) MUST NEVER FALL LOWER THAN THE ANGLE SPECIFIED FOR THE SLING IN USE

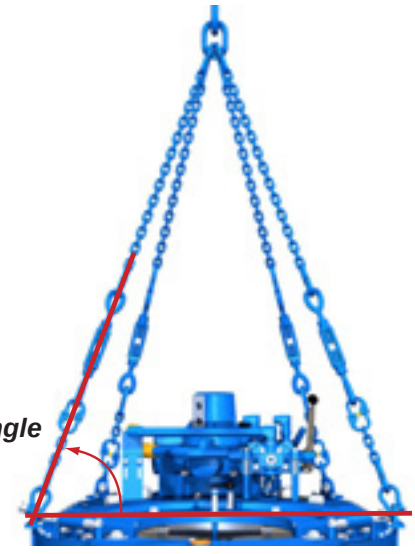

ILLUSTRATION 2.A.1: SLING ANGLE

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1. Inspection Of Slings

McCoy Completions & Drilling strongly recommends the following practices:

A complete inspection of new load-bearing devices and attachments shall be performed by a qualified, designated person prior to initial use. Each link and component shall be examined individually, taking care to expose and examine all surfaces including the inner link surface. The sling shall be examined for conditions such as those listed in the removal criteria below. In addition, daily inspection of slings, fastenings and attachments shall be performed by a designated person. If damage or defects are found at either inspection, the damaged or defective component shall be quarantined from service until it can be properly repaired or replaced.

Removal Criteria:

A load-bearing device shall be removed from service if conditions such as the following are present:

- *Missing or illegible sling identification.*
- *Cracks or breaks*
- *Evidence of tampering is seen - sling tag has been modified or obscured, or tamper-proof nuts are missing.*
- *Signs of impact on load-bearing components, including spreader bars, lifting lugs, rigid slings & rigid sling weldments, and legs & leg mounts.*
- *Broken or damaged welds.*
- *Excessive wear, nicks, or gouges. Refer to the chart below to ensure minimum thickness on chain links supplied is not be below the values listed:*

Minimum Allowable Chain Link Thickness at Any Point			
Nominal Chain Size		**Minimum Thickness**	
Inches	MM	Inches	MM
7/32	5.5	0.189	4.80
9/32	7	0.239	6.07
5/16	8	0.273	6.93
3/8	10	0.342	8.69
1/2	13	0.443	11.26
5/8	16	0.546	13.87
3/4	20	0.687	17.45
7/8	22	0.750	19.05
1	26	0.887	22.53
1-1/4	32	1.091	27.71
Refer To ASME B30.9			

- *Stretched, bent, twisted, or deformed chain links or components.*
- *Evidence of heat damage.*
- *Excessive pitting or corrosion.*
- *Lack of ability of chain or components to hinge (articulate) freely.*
- *Weld splatter.*
- *For hooks, removal criteria as stated in ASME B30.10*
- *Other conditions, including visible damage, that cause doubt as to the continued use of the sling.*

Inspect all lugs and fixing points for signs of elongation and/or bending, or for material build-up around the hole. Repair or replace components that appear distorted. Ensure all hardware is tight and in good condition. Replace missing hardware if necessary. All hardware must be free of rust and corrosion.

Additional inspections shall be performed during sling use where service conditions warrant. Periodic inspection intervals shall not exceed one year. The frequency of periodic inspections should be based on:

- *Frequency of use of the load-bearing device.*
- *Severity of service conditions*
- *Nature of lifts being made*
- *Experience gained on the service life of load-bearing devices used in similar circumstances.*

Guidelines for the interval are:

- *Normal Service - yearly*
- *Severe Service - monthly to quarterly*
- *Special Service - as recommended by a qualified person*

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Units designed and manufactured in accordance with EN 12079 and DNV 2.7-1 should be tested and examined in accordance with the following schedule of examination and test. The user of the load-bearing device shall place a permanent placard or plate upon which the type and date of the last test shall be recorded. To avoid confusion, the plate shall not carry the date of the next test or examination, only the most recent.

Test / Examination				
Time / Interval	Lifting Tests[1]	Non-Destructive Examination (NDE) of Lifting Points	Thorough Visual Examination	Suffix To Be Marked On Plate Attached To Unit
Initial Certification By Farr® / Superior	YES	YES	YES	T
Interval Not Exceeding 12 Months	At the discretion of inspection body	At the discretion of inspection body	YES	T or VN[3]
Interval Not Exceeding 60 Months	At the discretion of inspection body	YES	YES	T or VN
Following Substantial Repair or Alteration[4]	YES	YES	YES	T

1. Lifting test as per S 7.3 BS EN 12079 or DNV 2.7-1 May 1995
2. T = Proof Test, non-destructive examination; VN = non destructive examination and visual examination; V = visual examination.
3. Dependant upon whether non-destructive examination has been carried out.
4. For the purposes of this standard, a substantial repair or modification is defined as any repair and/or modification that has been carried out which may, in the opinion of the inspection body, affect the load-bearing elements of the container or lifting device, or elements that contribute directly to its structural integrity.

IF MECHANICAL DAMAGE IS SEEN OR SUSPECTED ON A LOAD-BEARING DEVICE, OR IF THE LOAD-BEARING DEVICE HAS BEEN OVERLOADED, IT MUST BE REMOVED FROM SERVICE AND QUARANTINED UNTIL RECERTIFIED

Written records of the most recent periodic inspection shall be maintained, and shall include the condition of the sling.

2. *Proper Use Of Load-Bearing Devices*

Whenever any load-bearing device is used, the following practices shall be observed.

- *Load-bearing devices that are damaged or defective shall not be used.*
- *Slings shall not be shortened with knots or bolts or other makeshift devices.*
- *Sling legs shall not be kinked.*
- *Load-bearing devices shall not be loaded in excess of their rated capacities.*
- *Slings shall be securely attached to their load.*
- *Load-bearing devices shall be protected from snagging, and shall not be further obstructed by any object.*
- *Suspended loads shall be kept clear of all obstruction.*
- *All employees shall be kept clear of loads about to be lifted and of suspended loads.*
- *Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.*
- *Shock loading is prohibited.*
- *Do not stand directly under a load during lifting.*

3. *Storage Of Load-Bearing Devices*

Proper storage of out-of-service load bearing devices is important to ensure full integrity of the device once it is returned to service. Farr® recommends observing the following practices:

- *Wipe off all excess grease. Use a solvent-based cleaner on rags to wipe all external surfaces to remove residual grease or hydraulic fluid. Once the outside surfaces have been de-greased, wipe all external surfaces with clean water to remove residual solvent.*
- *Farr® recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external surfaces. Refer to manufacturer data sheets for proper application and safety information. Allow the anti-corrosive coating ample time to dry - refer to manufacturer data sheets for drying times at room temperature.*
- *Store in a clean, dry location. When returning to service, note that a full inspection of the device must be performed.*

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Adequate setup and proper hydraulic connections are essential in ensuring reliable operation of your tong. For best results and long term reliability, read and obey the start-up instructions in this section.

B. MAJOR COMPONENT IDENTIFICATION

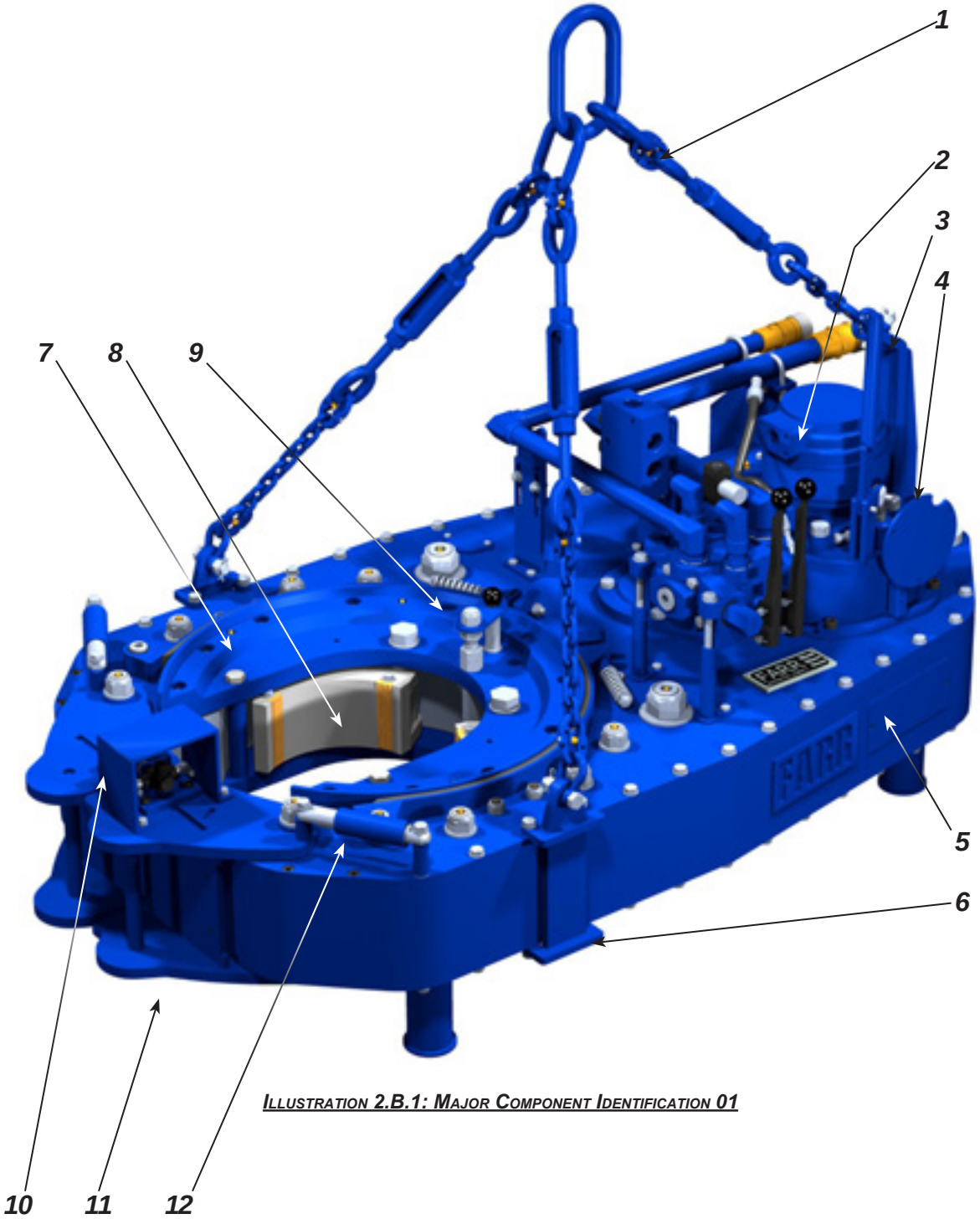

ILLUSTRATION 2.B.1: MAJOR COMPONENT IDENTIFICATION 01

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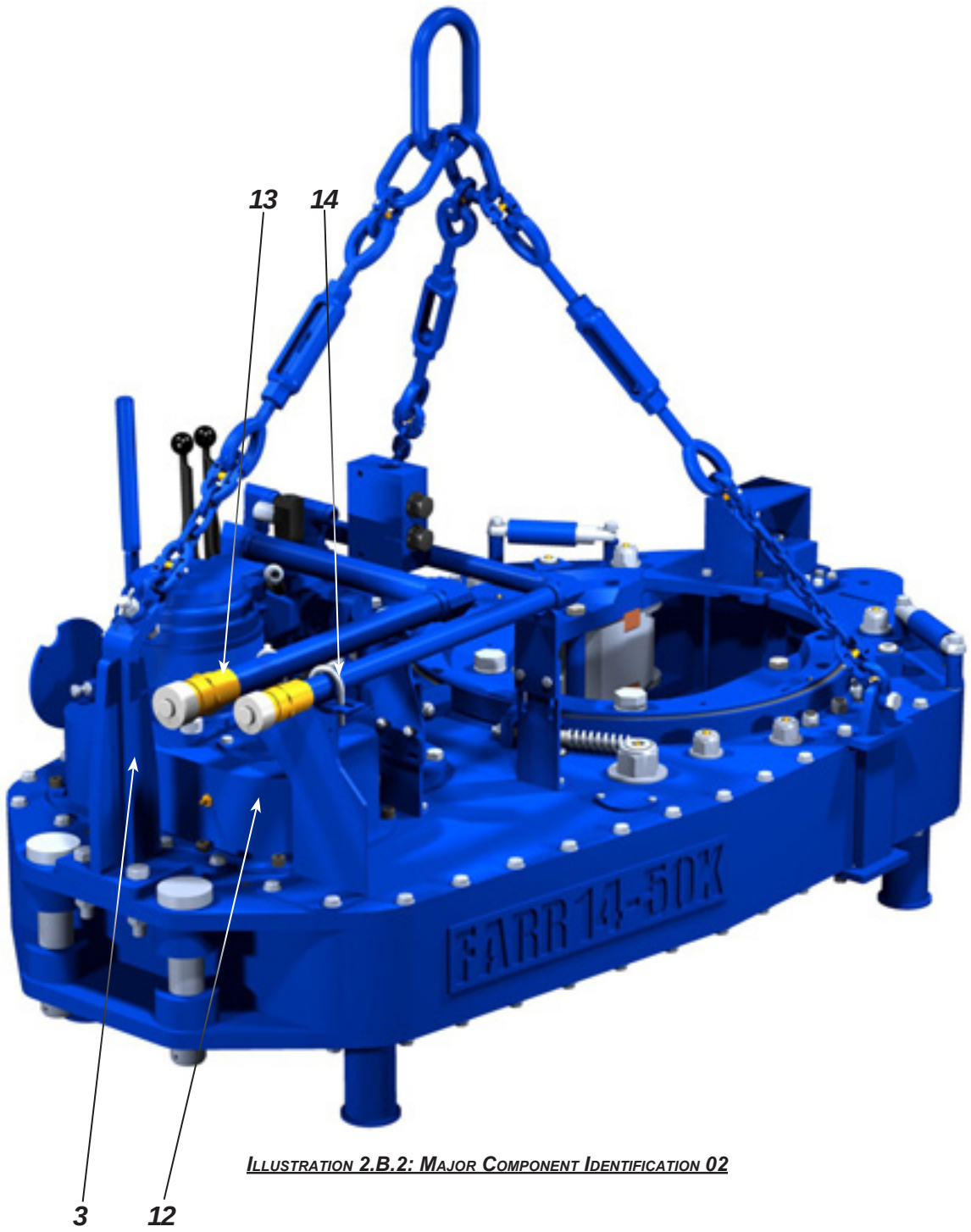

Illustration 2.B.2: Major Component Identification 02

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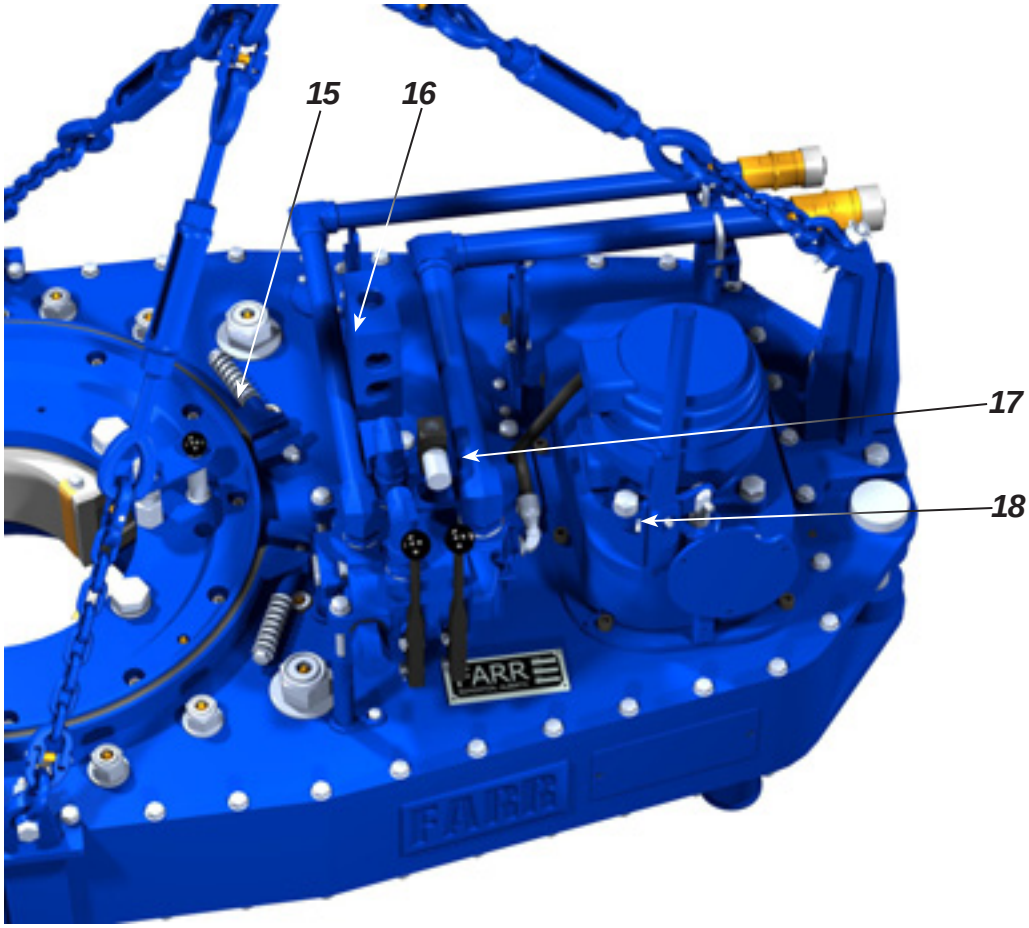

ILLUSTRATION 2.B.3: MAJOR COMPONENT IDENTIFICATION 03

Item	Description	Page
1	Chain Sling	2.4
2	Rineer GA 37 / 26 Hydraulic Motor	2.4
3	Rear Chain Sling Hanger	2.4, 2.5
4	Torque Gauge Mounting Plate	2.4
5	Access Panel	2.4
6	Front Chain Sling Hanger	2.4
7	Cage Plate Assembly	2.4
8	Tong Jaws with Die Inserts	2.4
9	Backing Pin Assembly	2.4
10	Safety Door Switch Assembly	2.6
11	Tong Door	2.4
12	Tong Door Cylinder	2.4, 2.5
12	Motor Mount	2.5
13	Hydraulic Outlet	2.5
14	Hydraulic Inlet	2.5
15	Brake band Adjustment	2.6
16	Safety Door Valve Block	2.6
17	Valve Bank Assembly	2.6
18	Manual Shift Assembly	2.6

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C. HYDRAULIC SCHEMATIC / COMPONENT IDENTIFICATION

Your tong may be equipped with one or two control valves, as well as safety door switch and hydraulics, depending upon the specific model. Disregard the control valves indicated on the following schematics that do not apply to your model.

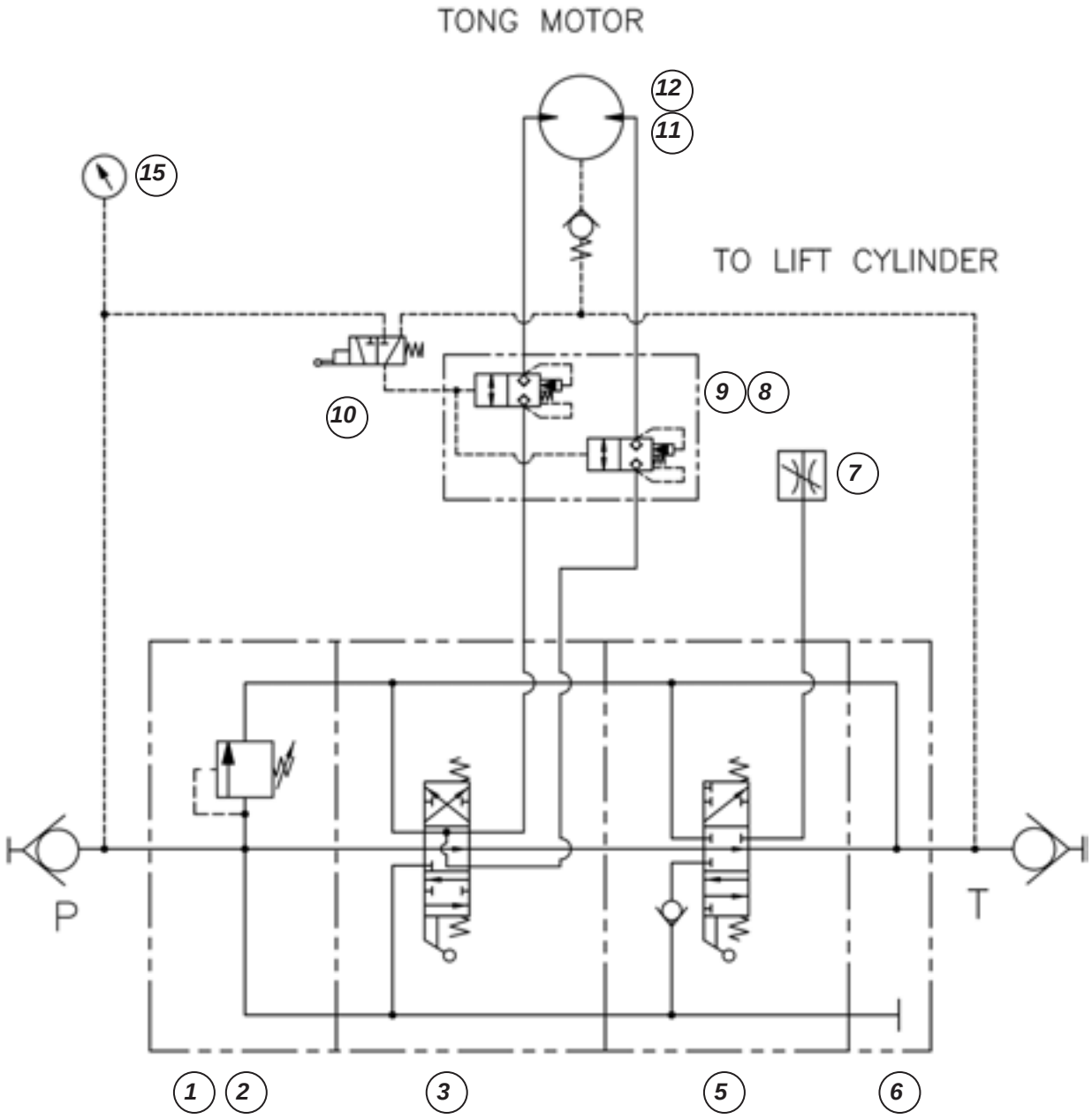

ILLUSTRATION 2.C.1: HYDRAULIC SCHEMATIC (TWO-VALVE)

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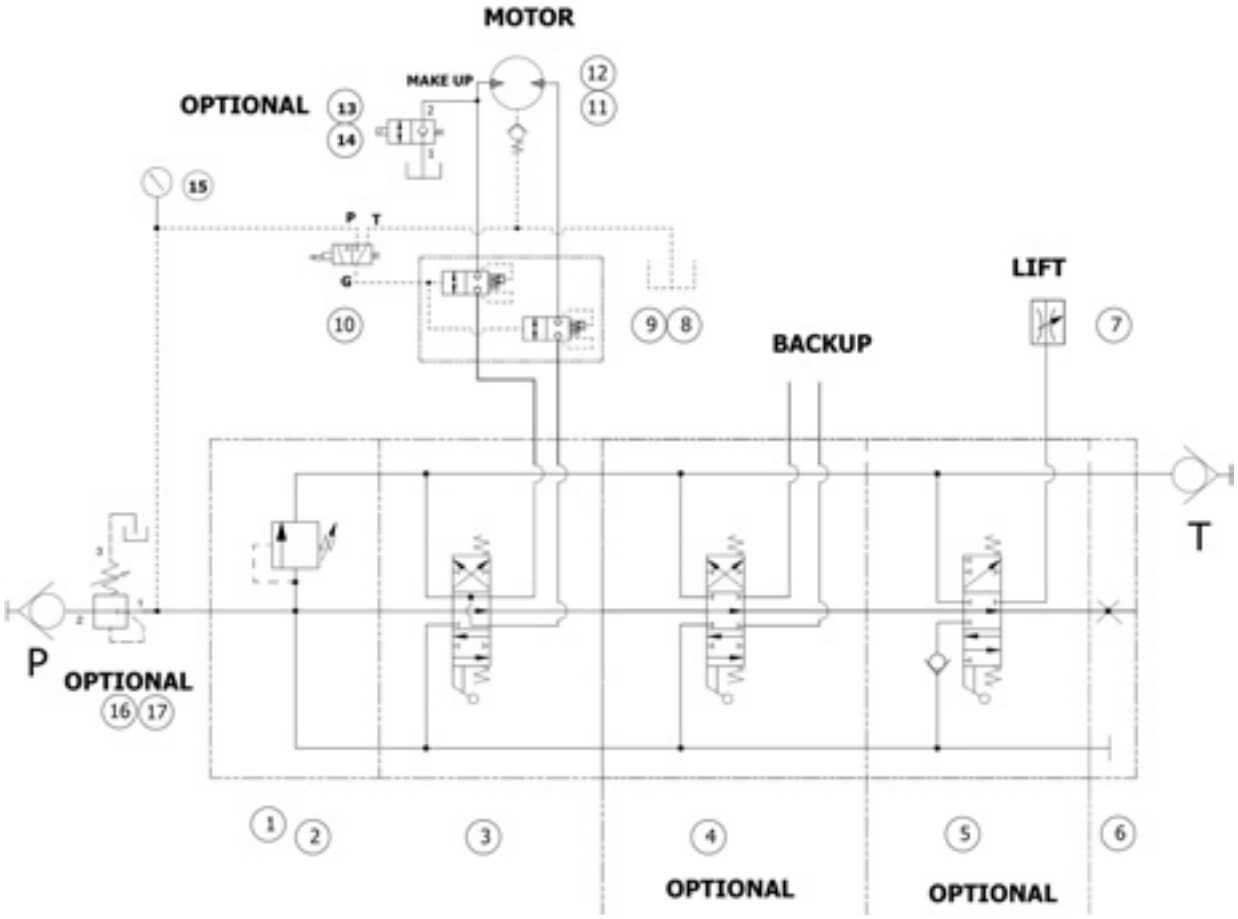

ILLUSTRATION 2.C.2: HYDRAULIC SCHEMATIC (3 VALVE)

Item	Description	Part Number
1	Inlet Valve DVA35-A880 w/2500 TO 3500 DVG35 HMRV CARTRIDGE	10-9016
2	Relief Valve (Varies according to customer specifications)	
3	Motor Section, DVA35-MA8, 4WAY SAE PORTS	10-9014
	Motor Section, DVA35 HI BOY (applies only to model 80-1001-6)	10-0001
4	Backup Section, DVA-DA8, 1” ORB PORT (Optional) (Not Shown)	10-9019
5	Lift Section, DVA-SA8, 1” ORB PORT (Optional)	10-9015
6	Outlet Section, DVA35-TR99, SAE PORT (Open Centre)	10-0086
	Outlet Section, DVA35-PB90, Modified, SAE PORT (Closed Centre)	08-1825M
7	Flow Control Valve, N800S	08-9062
8	Pilot-To-Operate Cartridge Valve, LKHC-XDN	08-1625
9	Safety Door Valve Block	101-0727
10	Safety Door Switch	08-0337
11	Check Valve (Varies according to customer specifications)	
12	Hydraulic Motor (Varies according to customer specifications)	
13	Dump Valve, SV2-20-C-0-24D (Not Shown)	08-9284
14	Dump Valve Body, S66409 (Not Shown)	08-9283
15	0 - 3000 PSI Pressure Gauge	02-0245
16	Pressure Reducing Valve, PRJR-LAN	08-1752
17	Valve Body, KCM	08-1753

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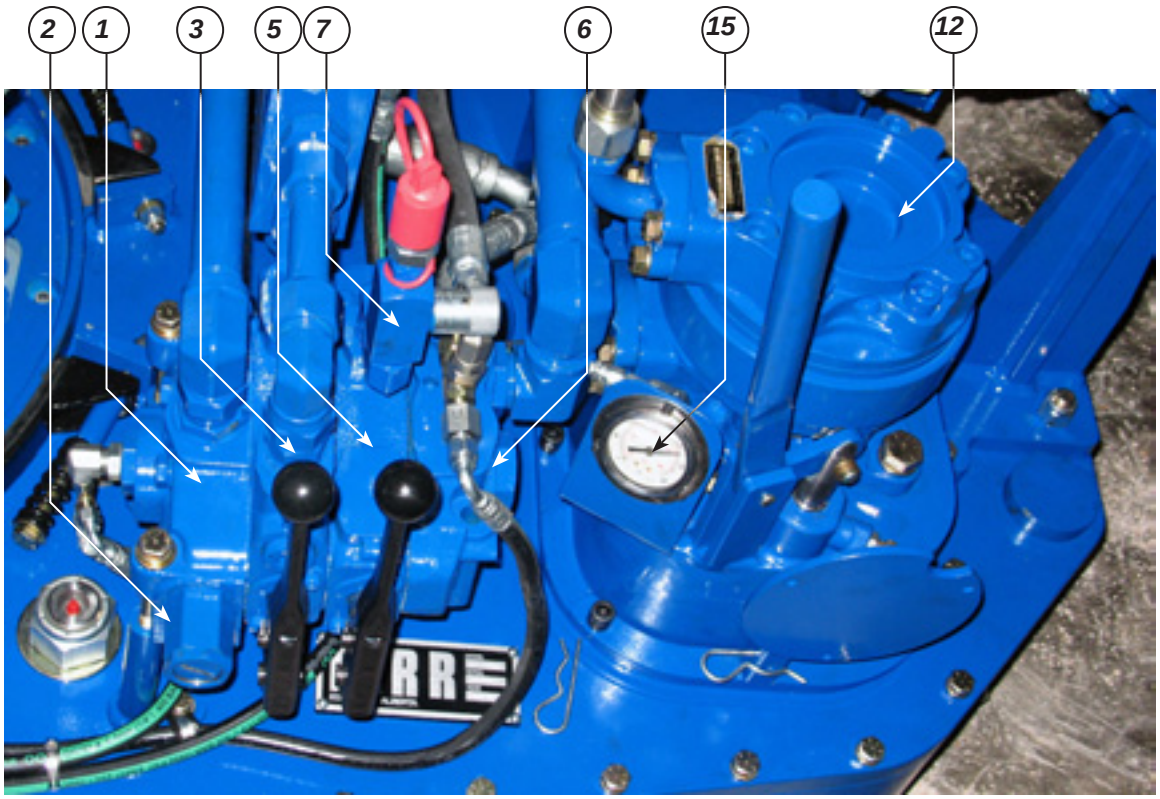

Illustration 2.C.3: Hydraulic Component Identification 01

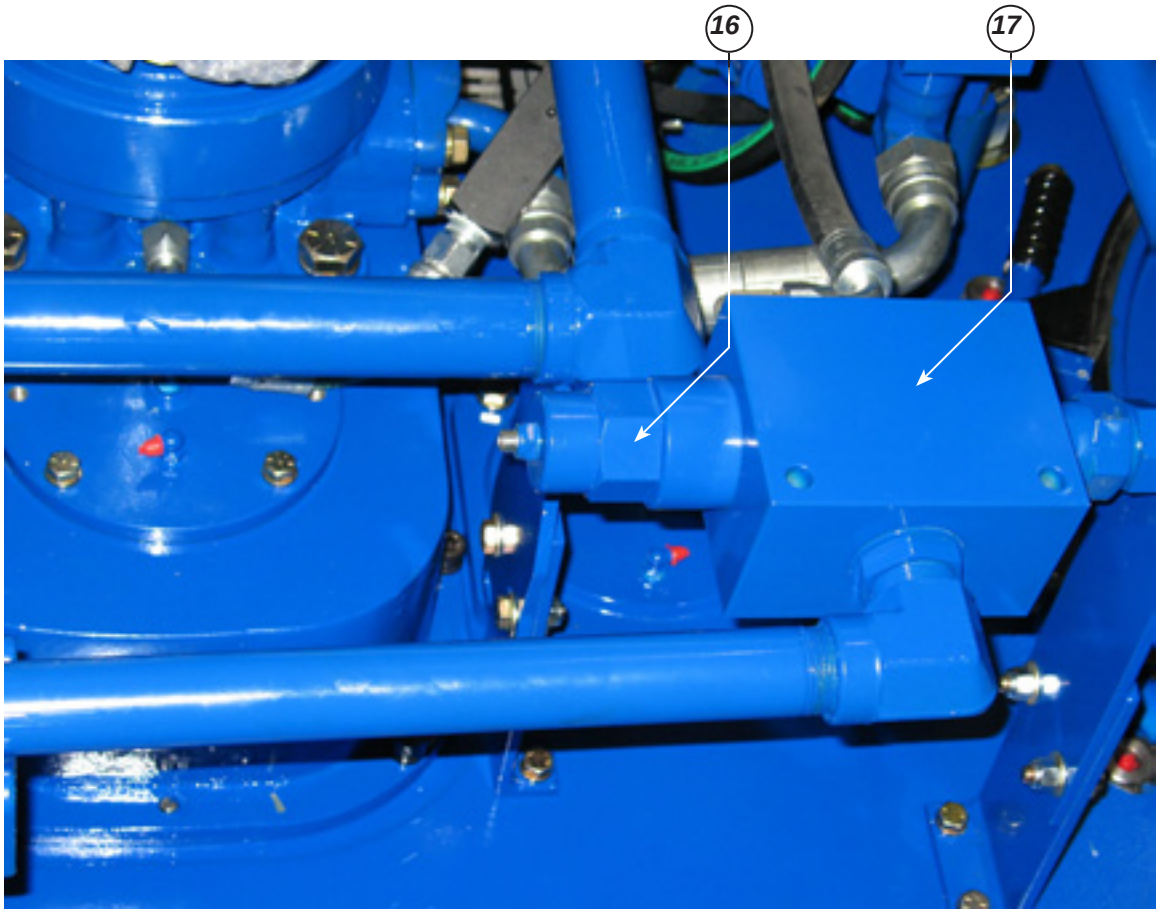

Illustration 2.C.4: Hydraulic Component Identification 02

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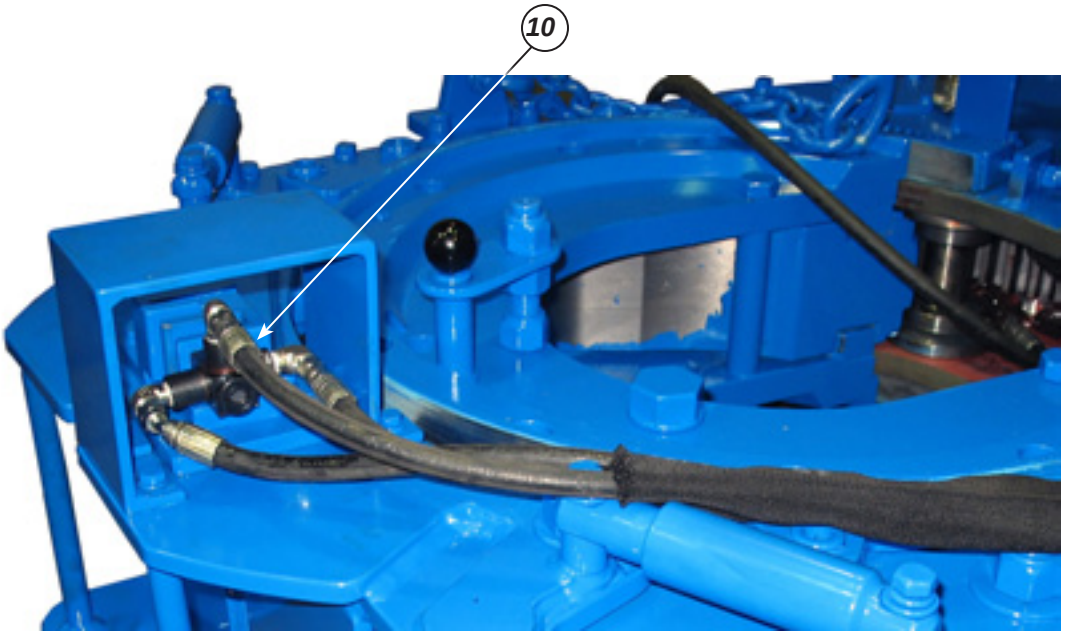

Illustration 2.C.5: Hydraulic Component Identification 03

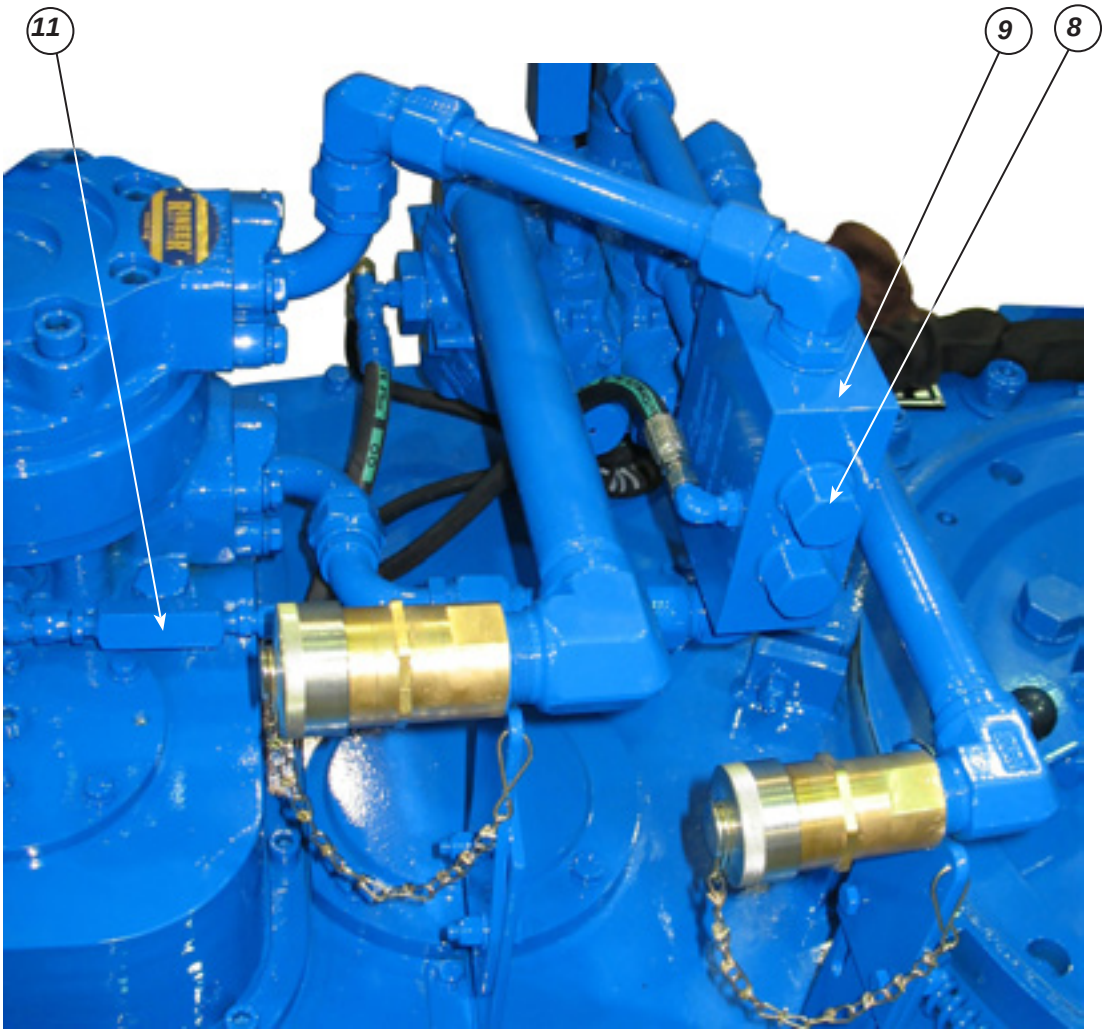

Illustration 2.C.6: Hydraulic Component Identification 04

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D. HYDRAULIC CONNECTIONS

A pair of hydraulic lines - a 1-1/4” supply line and a 1” return line - connect the tong to the power unit (see illustration below). Ancillary devices (hydraulic motors, hydraulic cylinders, etc.) are connected through the valve block.

Perform any hydraulic connection when the power unit is not running, or when the hydraulic pump is disengaged. The possibility of error in inter-changing the high pressure supply hose and the low pressure return hose has been eliminated, because the supply side coupling is smaller than the return side.

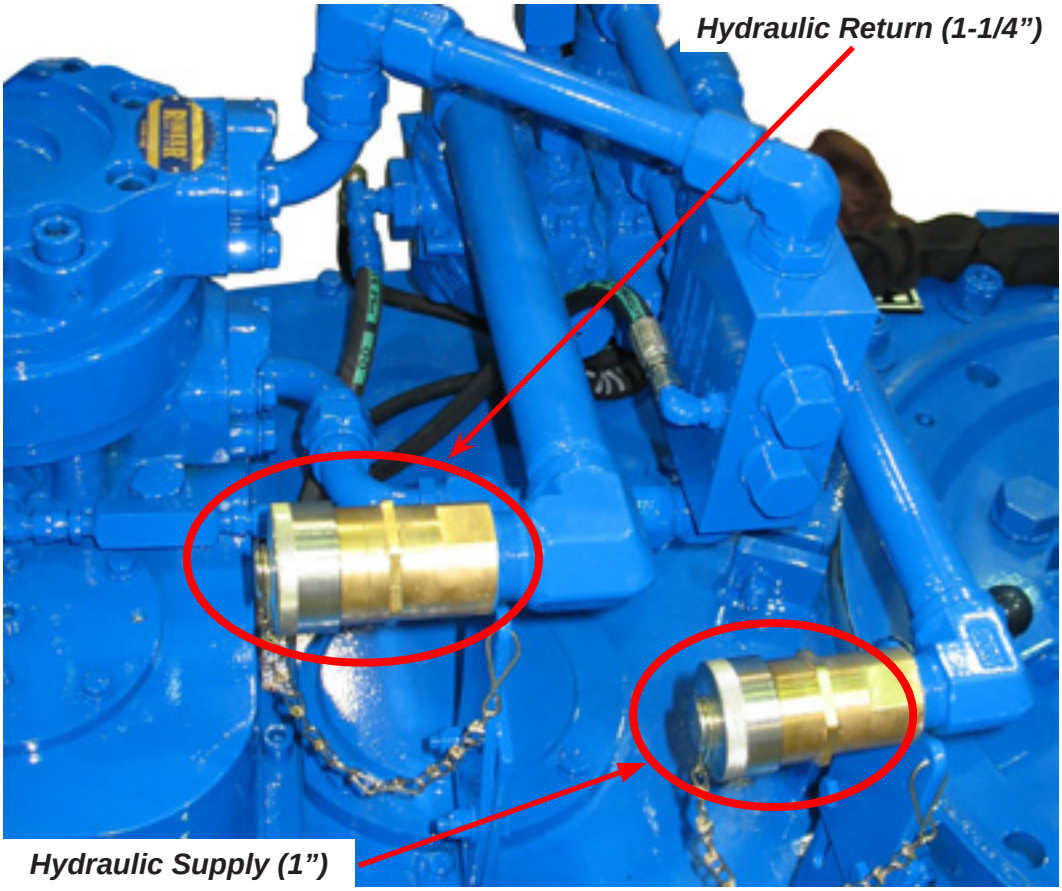

ILLUSTRATION 2.D.1: HYDRAULIC CONNECTIONS 01

These hose couplings are self-sealing, and care should be taken to ensure complete engagement to prevent partial closure of the check valve in the coupling. Ensure that the nut (female) side is completely made up onto the male connector - there is a line on the male fitting that indicates complete make-up. Snug the female fitting right up to the line.

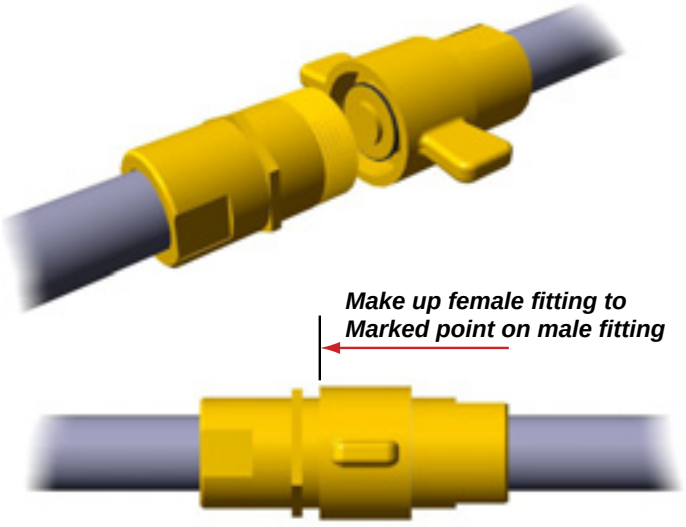

ILLUSTRATION 2.D.2: HYDRAULIC CONNECTIONS 02

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E. TONG JAW AVAILABILITY & INSTALLATION

1. Available Jaws

The following table lists all jaw die kits that are available as standard sizes for this model of tong. If your desired size is not listed, Farr can engineer custom jaw sizes - contact sales for further information.

Description	Part Number
4-1/2” Jaw Die Kit	1393-JDK-345
5” Jaw Die Kit	1393-JDK-350
5-1/2” Jaw Die Kit	1393-JDK-355
6-5/8” Jaw Die Kit	1393-JDK-360
7” Jaw Die Kit	1393-JDK-365
7-1/2” Jaw Die Kit	1393-JDK-368
7-5/8” Jaw Die Kit	1393-JDK-370
7-3/4” Jaw Die Kit	1393-JDK-371
8-1/4” Jaw Die Kit	1393-JDK-372
8-1/2” Jaw Die Kit	1393-JDK-373
8-5/8” Jaw Die Kit	1393-JDK-375
9-5/8” Jaw Die Kit	1393-JDK-380
9-7/8” Jaw Die Kit	1393-JDK-385
10” Jaw Die Kit	1393-JDK-188
10-3/8” Jaw Die Kit	1393-JDK-387
10-3/4” Jaw Die Kit	1393-JDK-390
11” Jaw Die Kit	1393-JDK-393
11-3/4” Jaw Die Kit	1393-JDK-395
11-7/8” Jaw Die Kit	1393-JDK-397
13-3/8” Jaw Die Kit	1393-JDK-400
13-5/8” Jaw Die Kit	1393-JDK-402
14” Jaw Die Kit	1393-JDK-405
14-3/8” Jaw Die Kit	1393-JDK-410
Flat Die Insert	12-1005

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2. Tong Jaw Installation & Removal

Support the jaw from the bottom, and remove the jaw pivot bolt. Slide the jaw toward the centre of the cage plate, and when the jaw clears the upper and lower cage plates, remove.

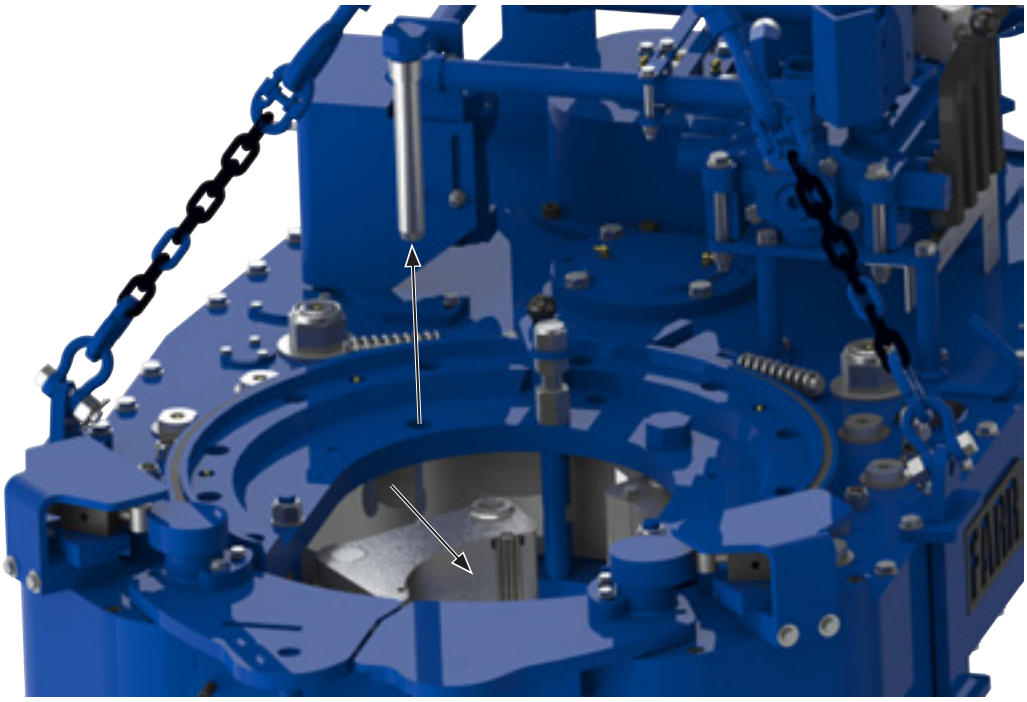

ILLUSTRATION 2.E.1: JAW REMOVAL

Remove die inserts by tapping lightly from the bottom until they loosen, and slide them out the top of the groove.

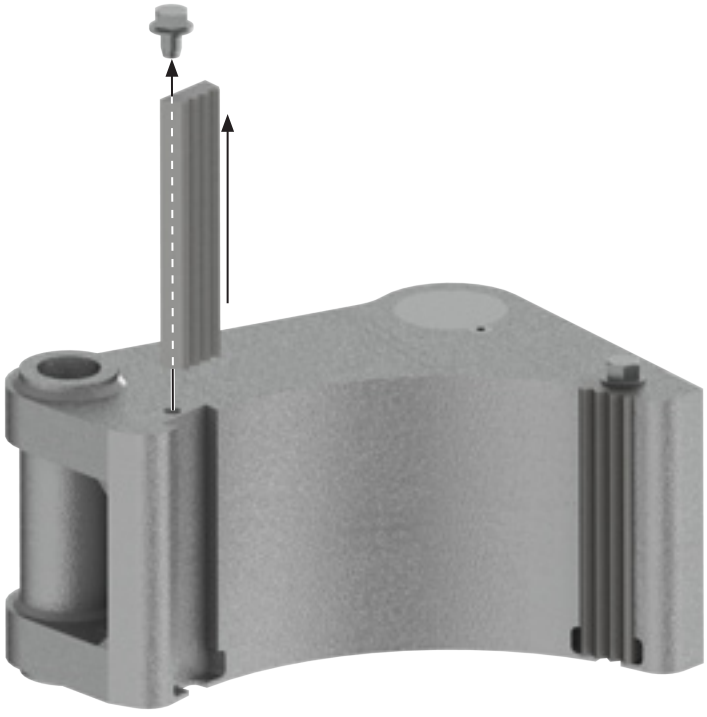

ILLUSTRATION 2.E.2: JAW DIE REMOVAL

Reverse this procedure to install or replace jaws.

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F. TONG RIG-UP & LEVELING

1. Suspension & Tong Restraint

Suspend the tong from a location as near to the centre of the drill rotary as possible, and from a location high enough on the mast to ensure easy handling. The lower the point from which the tong is suspended, the more effort will be required to move the tong to and from the connection point.

The suspension line may be extended over a pulley and balanced by a counterweight equal to the weight of the tong, or simply tied off in the derrick to form a dead line. When using a dead line arrangement it is necessary to use a FARR spring hanger assembly (see specification page for recommended spring hanger). This spring hanger compensates for the downward movement of the casing as the thread is made-up, and imparts additional force to the suspension cable:

- *a “single spring” hanger typically applies 420 lbs. (191 kg.) to the suspension line for every inch of thread made up*
- *a “double spring” hanger typically applies 840 lbs. (382 kg.) to the suspension line for every inch of thread made up*

If you do not know which specific spring hanger is in use, check the specification page in this manual for information on the recommended spring hanger for this application. McCoy Drilling & Completions will not guarantee or specify spring hangers other than what has been supplied by McCoy.

Many applications use a lift cylinder for adjusting the height of the tong. Ensure the weight of the lift cylinder is known if it has not been included in the total weight of the tong.

All forces upon the suspension line must be considered when calculating necessary strength of the suspension line. The weight of the tong, the weight of the lift cylinder, the weight of the spring hanger, and the force imparted on the suspension line by the spring hanger must all be added together in order to arrive at the total force supported by the suspension line. Select your suspension line based upon the total force and the margins of safety dictated by the policies of your company and by established engineering practices. Ultimately, calculating the force on the suspension line and selection of the suspension line is the complete responsibility of the customer.

McCoy Drilling & Completions recommends using dual backup (snub) lines of sufficient strength to withstand the force imparted by the maximum rated torque of the tong in use. Calculate the force on the snub lines by dividing the maximum torque of the tong by the tong’s torque arm (expressed in feet). For example, an 50,000 lbs.-ft. tong with a 45 inch (3.75 ft.) torque arm will generate 13,333 lbs. of force against the snub line. Select your snub lines based upon the total force and the margins of safety dictated by the policies of your company and by established engineering practices. Ultimately, calculating the force on the snub line and selection of the snub line is the complete responsibility of the customer.

Snub lines must be securely connected to the rear of the tong, and tied off to a suitable anchor. One snub line must be secured to the load cell, which is then secured to the rear of the tong. The side of the tong the load cell connects to is dependant upon whether make-up or break-out activities are underway. To ensure accurate torque measurement, the torque measurement line must be connected perpendicular to the lengthwise axis of the tong, and perpendicular to the hang line (see illustrations 2.G.1 and 2.G.2). Connect the second snub line on the opposite side of the load cell, perpendicular to the lengthwise axis of the tong and perpendicular to the vertical.

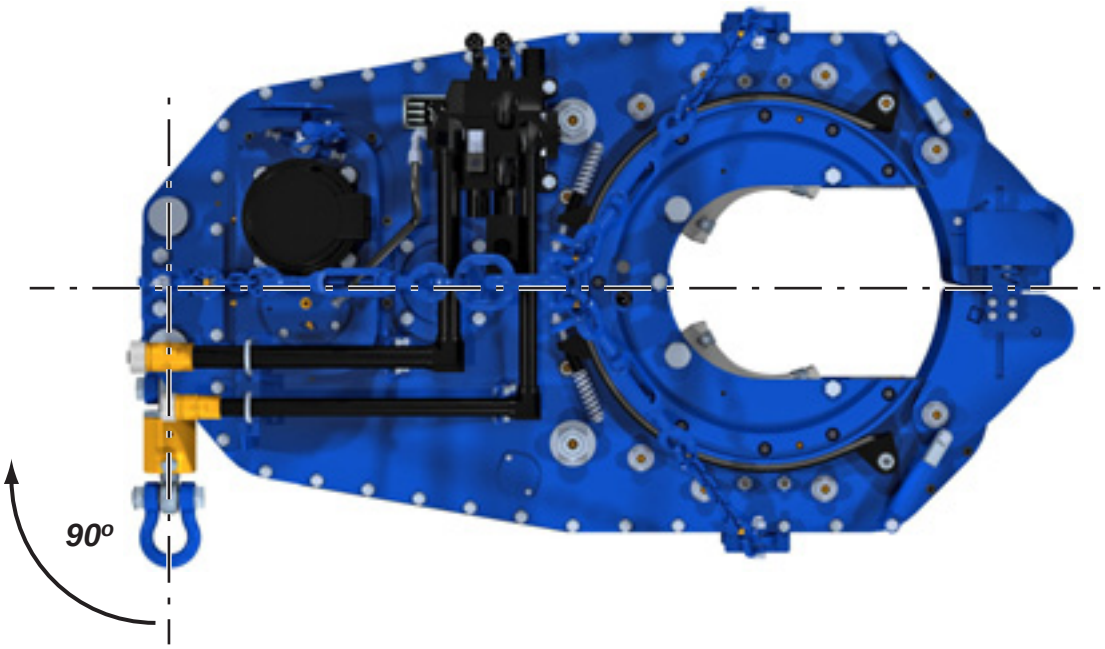

Illustration 2.F.1: Tong Suspension Relative To Axial Centre

Suspension & Restraint (Continued):

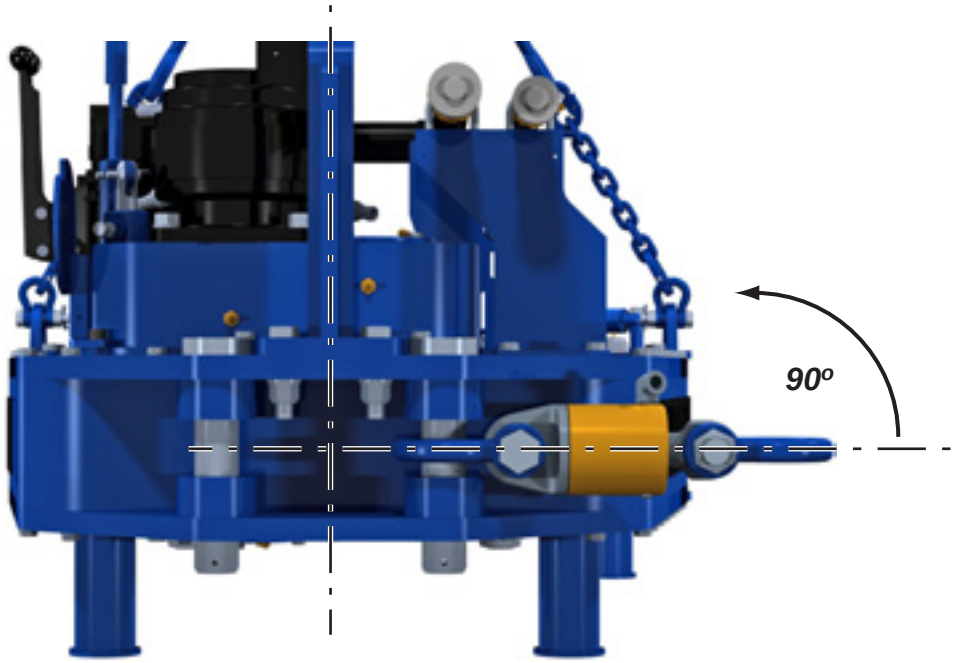

Illustration 2.F.2: Tong Suspension Relative To Vertical Centre

2. Tong Leveling

The tong must be leveled side-to-side and front-to-rear before placing into service. The following guidelines will assist you when leveling your tong.

i. Support the tong by the chain sling. Preset the positions of the side chains by rotating the turnbuckles on each side chain hanger until the eye bolts are about half-way engaged in the turnbuckle. The turnbuckles can often be turned by hand; if this is not the case, use an adjustable wrench across the flats on the turnbuckle to turn it. Rotating the turnbuckles in one direction will cause the two eye bolts to extend away from the centre of the turnbuckle, while rotating them in the other direction will cause the eye bolts to retract toward the centre of the turnbuckle. Place a level axially (side to side) across the tong, ensuring that it is parallel with the surface of the tong. Rotate the turnbuckle on one or the other side of the tong until the level indicates the tong is parallel - if there seems to be a large adjustment to make, split the adjustment between the turnbuckles on each side chain.

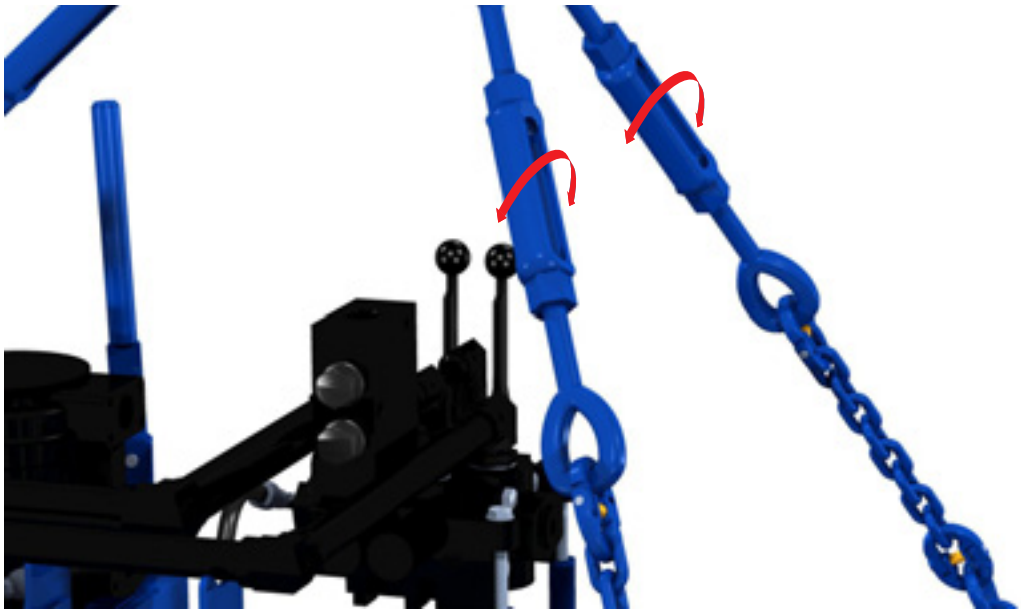

Illustration 2.F.3: Tong Leveling 01

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ii. *Preset the position of the rear chain the same way the side chains were set. Place a level lengthwise (front to back) along the tong, ensuring that it is parallel with the surface of the tong. Rotate the turnbuckle on the rear chain one way or the other until the level indicates the tong is parallel.*

ILLUSTRATION 2.F.4: TONG LEVELING 02

G. TONG OPERATION

1. Initial Start-up and Break-in Procedure

YOUR EQUIPMENT HAS BEEN THOROUGHLY TESTED AND INSPECTED AT THE FACTORY. HOWEVER, WE ADVISE INSPECTION AND TESTING OF YOUR NEW TONG AFTER TAKING POSSESSION IN ORDER TO ELIMINATE THE POSSIBILITY OF SHIPPING DAMAGE.

McCoy Completions & Drilling recommends that the following pre-operating tests be performed after receipt from the factory or after extended storage, prior to releasing the tong to operations:

- *Perform a complete inspection of all fasteners to ensure none have loosened during transport.*
- *Connect the tong to the power unit, and apply full hydraulic pressure. Inspect and correct any leaks.*
- *Operate the tong at full speed and in high gear for a duration of one-half hour. Hot bearing caps may indicate impending bearing failure.*
- *Switch to low gear and operate for an additional one-half hour at full speed.*
- *Inspect all components and hydraulic fittings for possible defects following completion of the tests. All Farr® Tongs have been thoroughly tested at the factory prior to shipping, but shipping damage must be identified before running the tong in an operational environment.*
- *Carefully inspect the safety door components, and test to ensure that the safety device on each door is operating correctly before releasing the tong to the operating environment.*

TONG DOOR MUST BE CLOSED AND SECURELY LATCHED BEFORE THE POWER UNIT IS STARTED IN ORDER TO ASSURE THE SAFETY OF OPERATING PERSONNEL

Ensure adequate lube oil and hydraulic oil levels before starting engine. Use start up procedures as recommended by the power unit engine operator’s manual. Open the Bypass Valve on the hydraulic system, and inspect all pressure and return line hose connections to ensure correct and secure installation.

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Initial Start-up and Break-in Procedure (Continued):

IMPROPERLY SECURED HYDRAULIC CONNECTIONS WILL INTERRUPT HYDRAULIC FLUID FLOW, AND COULD RESULT IN THE FOLLOWING FAILURES:

- *A restriction in the pressure supply hose will result in high pressure within the power unit hydraulic system, which will activate the hydraulic governor and increase the engine speed to as high as maximum RPM.*
- *A restriction in the return line will result in high pressure within the power unit and the tong hydraulic system, causing engine speeds as high as maximum RPM, and possible failure of the motor seal.*

Initial Start-up and Break-in Procedure (Continued):

Following inspection of the hoses, start the engine and allow it to idle until warm. Allow hydraulic fluid to circulate for approximately 10 minutes, then slowly close the Bypass Valve to allow hydraulic fluid to circulate through the hoses and to the tong (circulating pressure should not exceed 200 psi). Place the tong gear shifter in low gear and rotate the tong slowly forward and then reverse with the throttle valve control lever. Once this has been done and the proper size jaws have been installed, the tong is then ready to run pipe.

2. *Valve Operation*

4-way proportional valves control operation of hydraulic devices on the tong assembly such as hydraulic motors and cylinders. When any one valve is “centered” or in the detent position, there is no hydraulic output from the valve. When the valve is pushed forward there is an effect, and when the valve is pulled back, there is an opposite effect. These valves feature proportional control, which means that further extension of the valve handle (thereby further opening the valve orifice) results in proportionally higher hydraulic output to the controlled device.

The following illustration demonstrates the type and effect of the hydraulic valves with which this tong is may be equipped.

TONG MOTOR

This is a proportional valve. Pushing the valve handle forward will cause the tong motor to rotate in a clockwise direction (as seen from the top of the tong). This is the desired direction of rotation for making up a joint. Pulling the valve handle in the opposite direction results in counter-clockwise rotation, which is the desired direction of rotation for breaking out a joint.

Illustration 2.G.1: Tong Rotation Control Valve

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LIFT CYLINDER (If Equipped)
This is a direct-acting valve. Pushing the valve handle forward will cause the lift cylinder to lift the tong vertically. Pulling the valve handle in the opposite direction will cause the lift cylinder to lower the tong.

ILLUSTRATION 2.G.2: TONG LIFT CYLINDER CONTROL VALVE

3. SHIFTING GEARS

*The shifting shaft has three “detent” positions identifying the **low speed/high torque** position, the “neutral” or free-spinning positon, and the **high speed/low torque** position. The detent strength may be adjusted by releasing the locknut on the detent tube and increasing or relaxing pressure on the detent spring. Ensure the locknut is tightened once the desired detent pressure has been set.*

To shift to the high-speed gear, move the shifting handle toward the rear of the tong, forcing the shifting shaft down. To shift to the low-speed gear, move the shifting handle towards the front of the tong, forcing the shifting shaft up. Note that the high clutch gear or the low clutch gear may not be exactly aligned when shifting, so the operator may need to “bump” the motor control handle slightly to turn the main clutch gear shaft and shifting collar into alignment. This is most effective when applying a small amount of pressure on the gear shift lever in the direction you want to shift the tong, ensuring the shifting collar will “catch” when the main clutch gear aligns with either the high or low clutch gear.

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

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Shifting Gears (Continued):

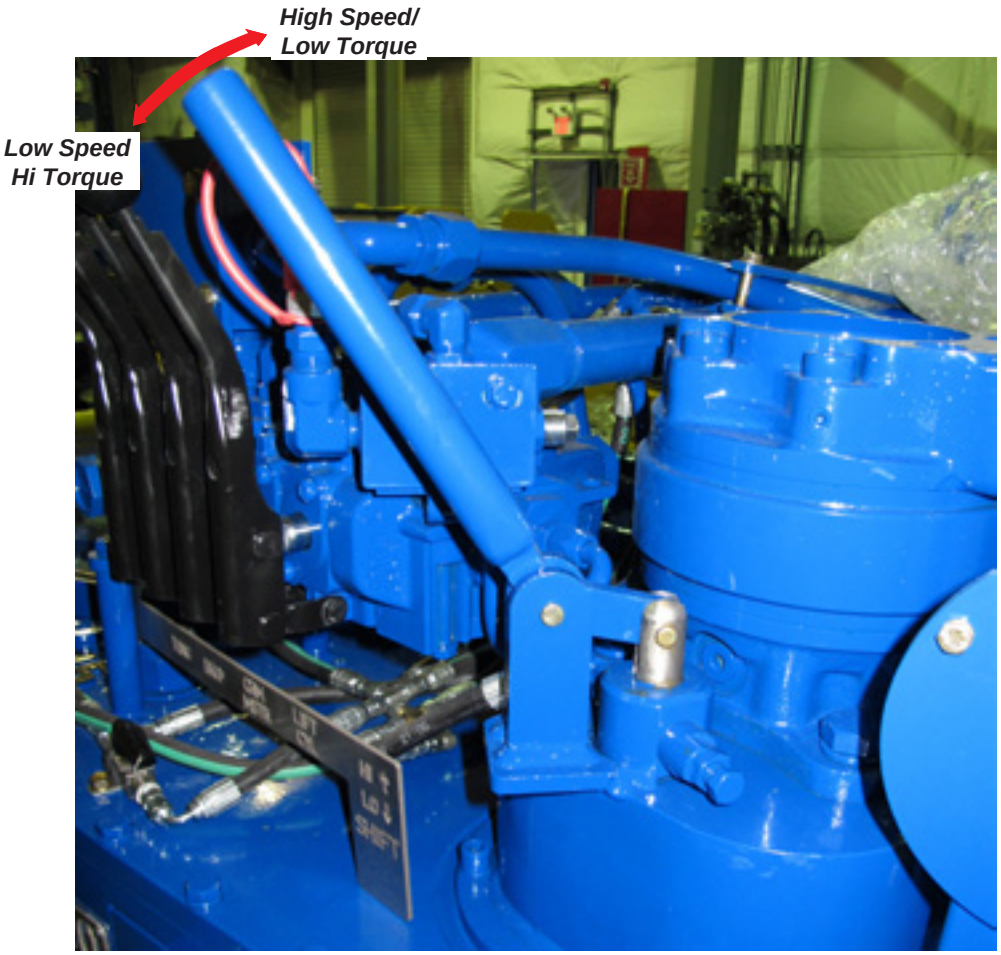

ILLUSTRATION 2.G.3: TONG MANUAL SHIFT CONTROL

4. General Comments

a) Position rotary gear in contact with both idler gears when breaking out joints or collars where high torques are required.

b) When making-up integral (shouldered) joints, it is essential to make up the last turn of the threads in low gear. This reduces the tendency of an instant stop or a sudden increase in torque, which induces extremely high stresses on the gear train.

c) DO NOT employ the “snap break” method of breaking-out joints when pulling a string. By definition, the “snap break” method is a procedure used by some operators to break out connections, accomplished by leaving slack in the “jaw-pipe” engagement, and then quickly pulling the throttle valve control lever allowing the tong to snap into its loaded or high torque condition. Although this method is very effective in breaking out joints, the extremely high stress placed on the gear train frequently causes gear breakage.

THE “SNAP-BREAK” METHOD IS HAZARDOUS TO RIG PERSONNEL AND EQUIPMENT

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H. MAKING AND BREAKING CONNECTIONS

THESE OPERATING PROCEDURES ASSUME THE USER HAS PROPERLY SET UP AND PREPARED THE EQUIPMENT FOR OPERATION AS PER SECTIONS 2D, 2E, AND 2F OF THIS MANUAL.

Set up and prepare your equipment for operation as per Section 2 of this manual Refer to the following sections:

- *2.D - Hydraulic Connections*
- *2.E - Electrical Connections*
- *2.F - Tong Jaw Installation*
- *2.G.1 - Tong Rig-up and Leveling (Suspension)*
- *2.G.2 - Tong Rig-up and Leveling (Leveling)*

Your tong and backup assembly should be properly suspended, connected to a hydraulic power source, and ready to make or break connections at this point.

1. Making A Connection

a) *Ensure hydraulic power supply to the tong is energized. The master link on the rigid sling must be used to suspend the tong. Do not suspend the tong from any other point.*

ILLUSTRATION 2.H.1: MASTER LIFTING LINK

THE MASTER LINK MUST BE USED TO SUSPEND THE TONG ASSEMBLY

b) *Ensure the backing pin is in the “makeup” position. From the front of the tong, the backing pin correctly configured for makeup will be in the 10 o’clock position (see Illustration 2.H.2 next page). If it is not, simply lift up and place in the correct position. The cage plate opening must be aligned with the door opening when setting the backing pin position.*

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Making A Connection (Continued)

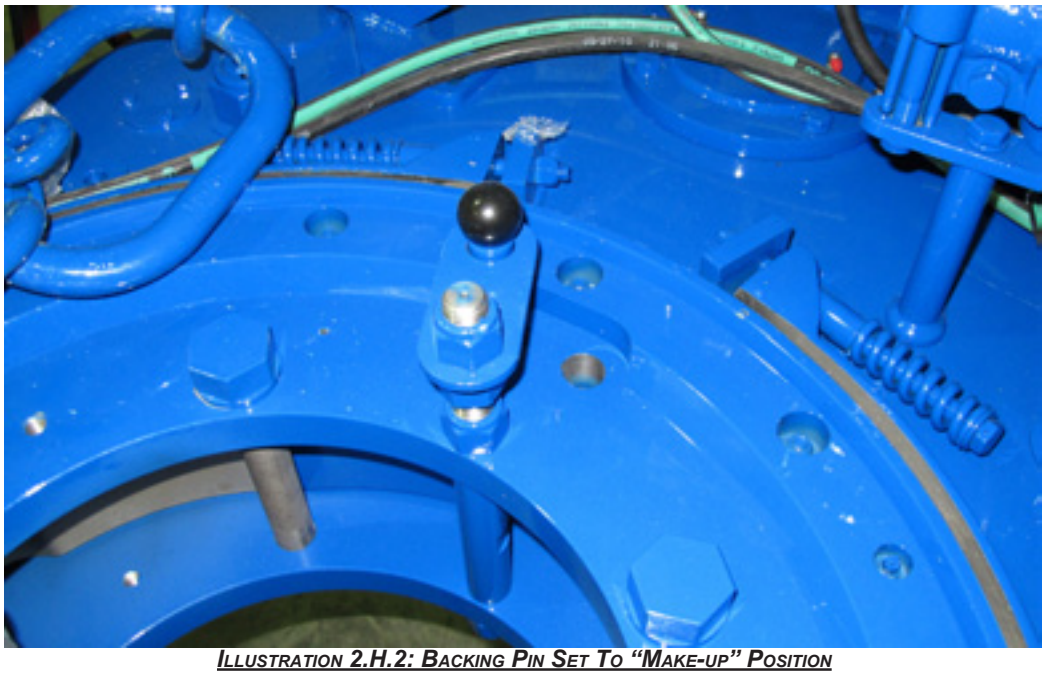

Illustration 2.H.2: Backing Pin Set To “Make-up” Position

c) *Ensure the load cell and snub line(s) are properly configured for making up connections. A “snub line” is a length of wire rope that connects the rear of the tong body to a sturdy anchor on the drill floor (see Section 2.F.1). The snub line prevents the tong body from spinning in the opposite direction of the cage plate when torque begins to build in the joint. Farr Canada Corp. recommends using two snub lines when running the equipment to eliminate uncontrolled movement in either rotational direction. The snub line(s) must be rated for the applied torque plus whatever safety margins stated by your own operating policies. The snub line connection point on the drill floor must be sturdy enough to absorb all applied forces when making up the joints. When making up joints the load cell must be connected to the driller’s side of the tong, which is the left side of the tong as seen from the rear. For accurate torque measurement the snub line between the tong body and the anchor must be perpendicular to the vertical, and perpendicular to the centre-line of the tong.*

d) *Actuate the lift cylinder control valve to lift the assembly from the drill floor. Pushing the valve toward the center of the tong will retract the lift cylinder to lift the assembly (see Illustration 2.H.3 below). Note that rig personnel are required to stabilize the tong and backup as it is being lifted so it does not swing and collide with other rig equipment.*

RIG PERSONNEL MUST STABILIZE THE TONG AS IT IS LIFTED FROM THE DRILL FLOOR

Illustration 2.H.3: Lift Cylinder Control (Raise)

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Making A Connection (Continued)

e) *Grasp the tong door handles and pull firmly to open. Since your equipment is equipped with safety doors, opening the door will inhibit rotation of the cage plate.*

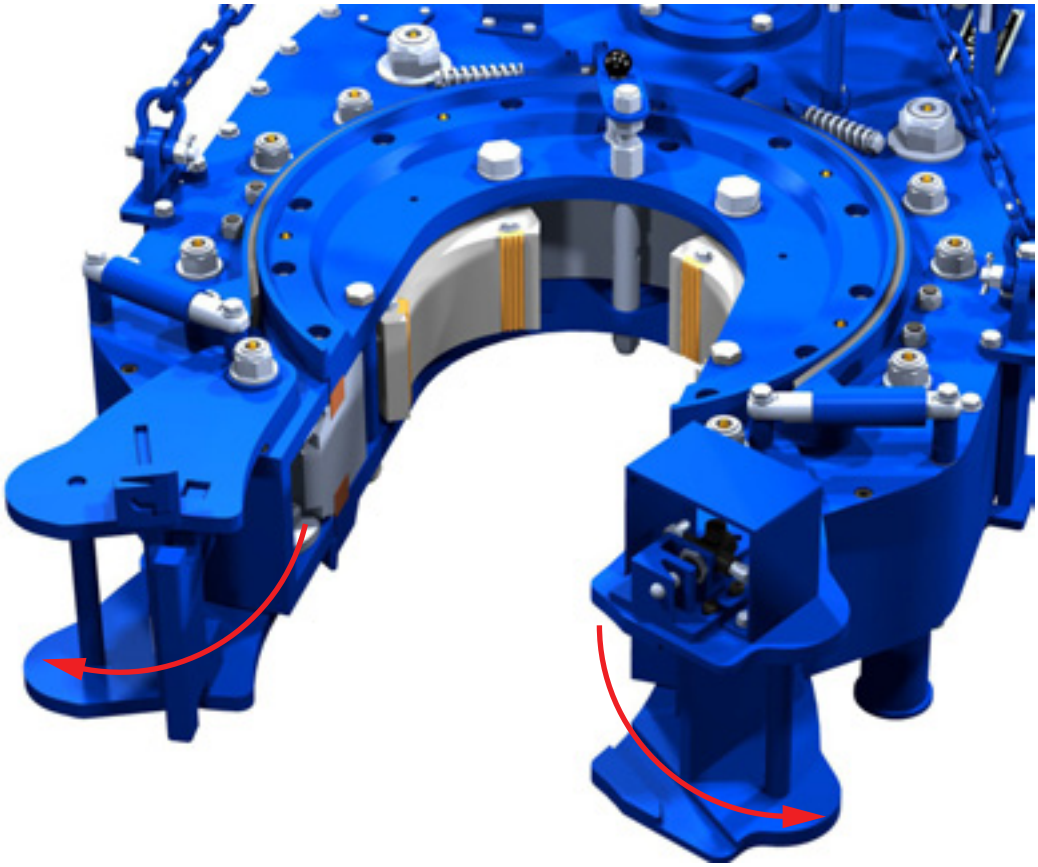

ILLUSTRATION 2.H.4: OPENING TONG DOORS

f) *Manually engage the threads of the tubing connection being made up. Ensure threads are not cross-threaded.*

g) *Move the tong on to the tubing joint. Use the lift cylinder to ensure the tong jaws are at the correct location above the connection joint.*

h) *Firmly close the LH tong door, followed by the RH tong door. Tug firmly on the LH door handle to ensure the latch is firmly engaged.*

i) *Ensure tubing is roughly centered within the tong jaws - rig personnel are required to stabilize the tong above the connection until the jaws have been cammed on to the pipe or casing.*

j) *Begin rotation with the tong in high gear (high speed/low torque). See Section 2.G.3 to properly set the tong to high gear. Do not shift gears while the tong is rotating.*

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

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Making A Connection (Continued)

k) Push the motor control valve toward the tong to rotate the cage plate in the make-up direction.

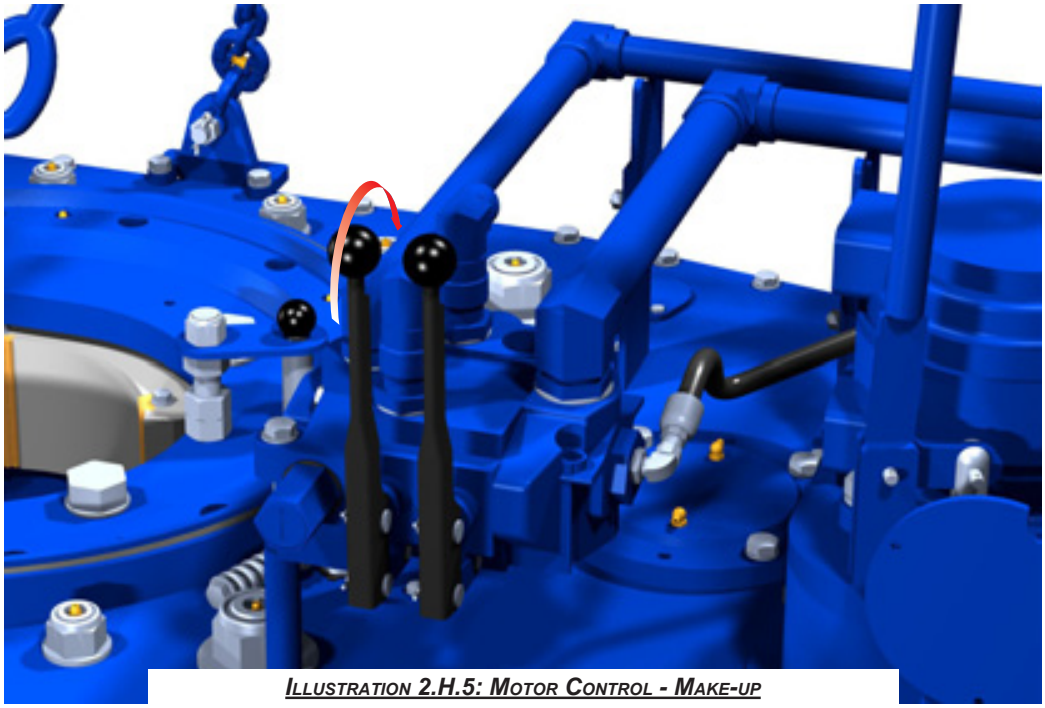

Illustration 2.H.5: Motor Control - Make-up

l) When the tong jaws cam on to the tubing push the rotation control handle all the way in to thread the connection together at high speed. As the joint becomes fully made up the increasing torque demand will stall the motor, and displayed torque will increase.

m) Stop rotation, and set motor to low speed and shift to low gear (low speed/high torque). See Section 2.G.3 for instructions for shifting to low gear. This will enable the tong to produce adequate torque for making up the joint to specification.

n) Push the rotation control handle all the way in to complete the connection at low speed/high torque. Observe the torque gauge - when the specified make-up torque is reached stop rotation. Reverse the rotation control valve to release the tong jaws from the tubing (see Illustration 2.H.6).

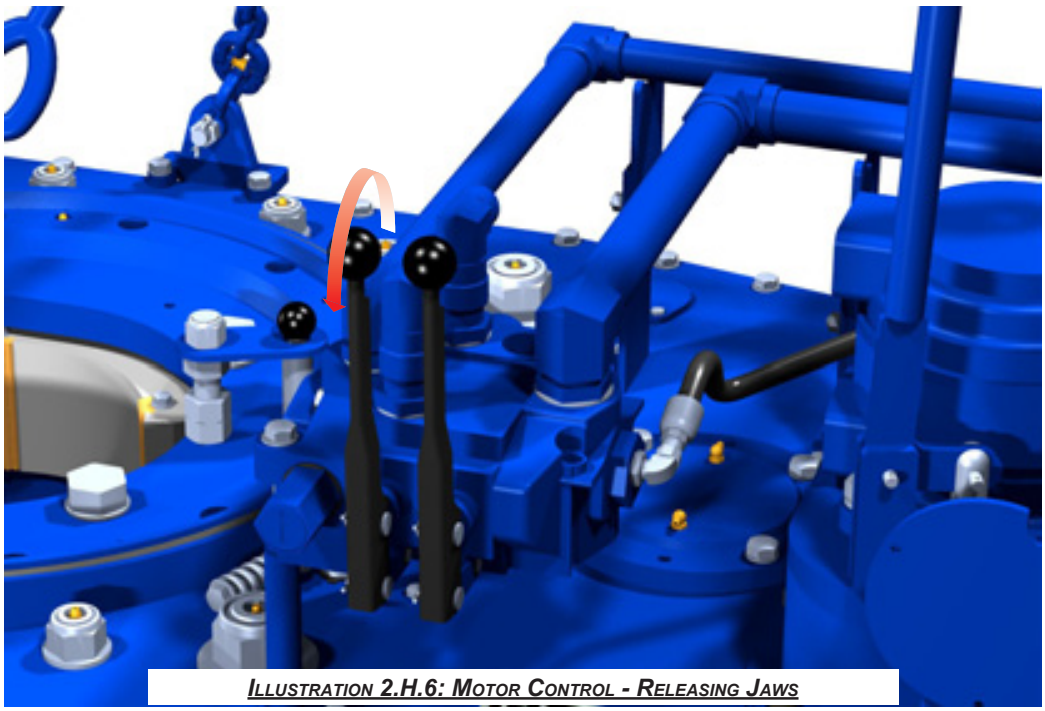

Illustration 2.H.6: Motor Control - Releasing Jaws

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Making A Connection (Continued)

o) When tong jaws are free align the opening in the rotary gear with the mouth of the tong, and open the tong doors to free the tong from the drill string. Note that rig personnel may be required to stabilize the tong as it completely releases from the drill string. Guide the tong away from the string and use the lift cylinder control to lower it to the drill floor if desired.

ILLUSTRATION 2.H.7: LIFT CYLINDER CONTROL - LOWER

p) Repeat steps “f” through “o” until the desired number of connections are made up.

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2. Breaking A Connection

YOUR TONG SHOULD BE PROPERLY SUSPENDED, CONNECTED TO A HYDRAULIC POWER SOURCE, AND READY TO BREAK CONNECTIONS.

a) *Ensure hydraulic power supply to the tong and backup is energized. The master link on the rigid sling must be used to suspend the tong. Do not suspend the tong from any other point. See Illustration 2.H.1.*

b) *Set the backing pin for “breakout” operation. Lift up on the backing pin and rotate it to the “breakout” position, which is 2 o’clock as seen from the front of the tong. The opening in the rotary gear must be aligned with the tong door opening in order to properly set the backing pin (see Illustration 2.H.8).*

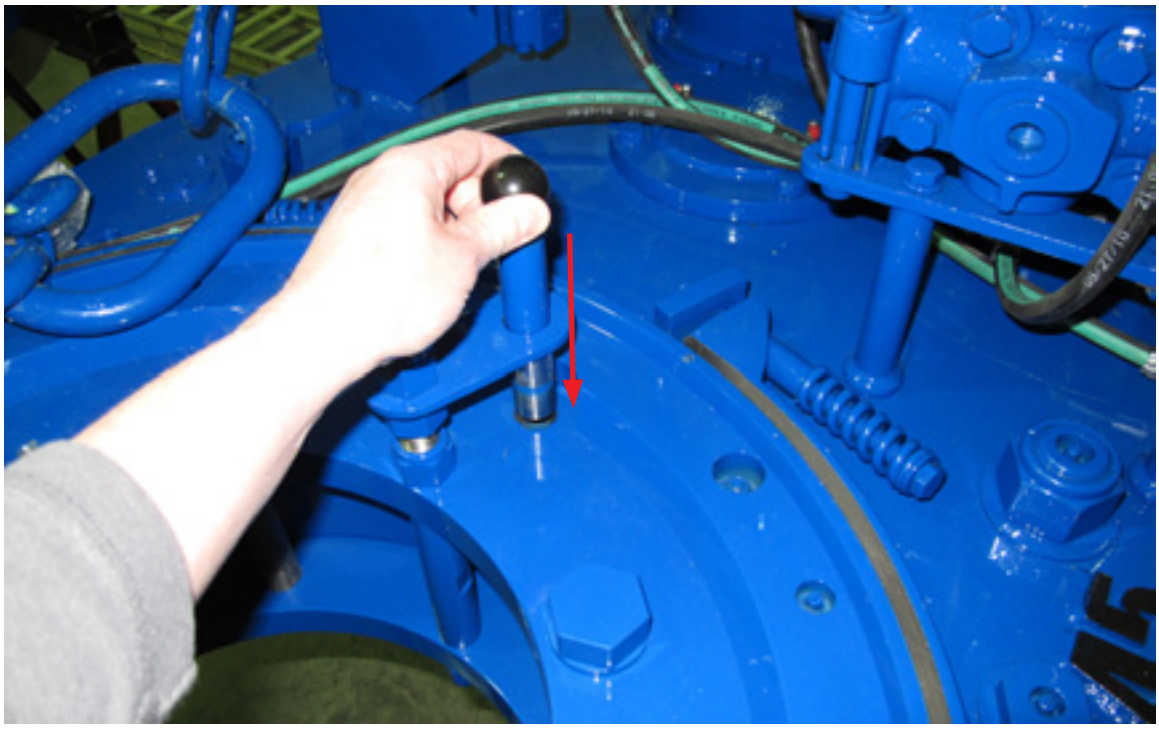

Illustration 2.H.8: Setting Backing Pin To “Break-Out” Position

c) *Ensure the load cell and snub line are configured for break-out operation. The load cell must be transferred to the off-driller’s side (the right hand side as seen from the rear of the tong), and the snub line must be transferred to the driller’s side to perform break-out operations.*

d) *Open the tong doors (see Illustration 2.H.4).*

e) *Actuate the lift cylinder control valve to lift the assembly from the drill floor if necessary. Pushing the valve toward the center of the tong will retract the lift cylinder to lift the assembly (see illustration 2.H.3). Note that rig personnel are required to stabilize the tong and backup as it is being lifted so it does not swing and collide with other rig equipment.*

RIG PERSONNEL MUST STABILIZE THE TONG AS IT IS LIFTED FROM THE DRILL FLOOR

f) *Move the tong on to the tubing joint. Use the lift cylinder to ensure the tong jaws are at the correct location above the connection joint.*

g) *Firmly close the tong door against the latch post.*

h) *Ensure tubing is roughly centered within the tong jaws - rig personnel are required to stabilize the tong above the connection until the jaws have been cammed on to the pipe or casing.*

i) *Breakout torque is only available when tong is in low gear. See Section 2.G.3 for instructions on shifting your tong to low gear. Do not shift gears while the tong is rotating.*

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Breaking A Connection (Continued)

j) Pull the motor control valve toward the operator to rotate the cage plate in the break-out direction.

ILLUSTRATION 2.H.9: ROTATION CONTROL - BREAK-OUT

l) When the tong jaws cam on to the tubing pull the rotation control handle all the way out to break the connection.

m) When the connection breaks stop rotation and shift to high gear (see Section 2.H.3 to shift to high gear). This will enable the tong to completely un-thread the connection at high speed.

n) Pull the rotation control handle all the way out to completely un-thread the connection. Reverse the rotation control handle (push toward tong) to release the tong jaws from the tubing (see Illustration 2.H.10).

ILLUSTRATION 2.H.10: RELEASING TONG JAWS FOLLOWING BREAK-OUT & UNTHREADING

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Breaking A Connection (Continued)

o) When the tong jaws disengage align the opening in the rotary gear with the mouth of the tong, and open the tong door to free the tong from the drill string. Unlatch and open the tong door to free the assembly from the tubing. Note that rig personnel may be required to stabilize the equipment as it completely releases from the tubing. Guide the assembly away from the string and use the lift cylinder control to lower it to the drill floor if desired.

ILLUSTRATION 2.H.11: LOWERING TONG USING LIFT CYLINDER CONTROL

p) Use your rig’s standard pipe handling procedures to remove and rack the freed tubing stand.

q) Repeat steps “e” through “p” as many times as necessary to break out and unthread the desired number of connections.

K. EXTREME COLD WEATHER OPERATION PROCEDURES

1) Consult the power unit engine operator’s manual for all cold weather operating procedures and precautions.

2) Select gear and bearing lubricants that are compatible with expected climatic conditions.

3) Select hydraulic fluid that is compatible with expected climatic conditions.

4) Allow hydraulic fluid to circulate for approximately 20 minutes after starting the power unit, prior to activating the bypass valve to allow fluid to circulate to tong. If the power unit is equipped with an oil temperature gauge, ensure that the fluid has reached operating temperature as specified by hydraulic fluid data sheet.

5) Allow for adequate drying of moisture (prior to lubricating) when cleaning tong parts in cold weather.

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McCoy Completions & Drilling recognizes that minor on-site repairs and modifications are required to maintain peak operating condition of your equipment, or to match your equipment with the operating environment. Examples of minor repairs are

- *replacement of damaged hydraulic hoses and fittings.*
- *replacement of malfunctioning pressure gauges and valves.*
- *replacement of door cylinders*
- *replacement of fasteners*

Any replaced component must be an identical component supplied by McCoy Completions & Drilling. Replaced fasteners must be Grade 8 or equivalent, or whatever fastener is specified by McCoy.

A. GENERAL MAINTENANCE SAFETY PRACTICES

The practices identified here are intended as a guideline. All personnel are responsible for performing their tasks in a manner that ensures worker, equipment, and environmental safety, and may require taking additional steps that are not identified in this section.

Equipment maintenance shall be performed only by designated qualified maintenance personnel. Wear approved eye wear and footwear, and follow all of your company’s safety guidelines Do not begin a maintenance task without the proper tools or materials on hand, or the proper drawings and documentation necessary.

Schedule planned maintenance with operators to avoid conflicts, unnecessary downtime, and the danger of accidental equipment activation. Notify operations when maintenance procedures are complete and equipment functionality is restored.

Isolate the location of the maintenance under way to prevent unaware personnel from inadvertently exposing themselves to a hazard. Use tape, rope, or signage to clearly indicate “off-limits” area.

Replacement of large, heavy individual parts and/or heavy structural components must be performed using an approved lifting device of sufficient lifting capacity. Use care when attaching the lifting device, and safeguard area to avoid endangering personnel or equipment.

All spare parts must meet or exceed OEM specifications in order to maintain equipment integrity, especially protective equipment

McCoy recommends that disconnection of hydraulic connectors be performed with the power unit off and the hydraulic circuit depressurized.

Your equipment uses materials that may be harmful to the environment if improperly disposed of (hydraulic fluid, grease, etc.). Dispose of all materials according to your company’s proscribed environmental protection regulations.

B. CLEANING

Clean tong thoroughly cleaned with a good petroleum-based cleaning agent after each job, prior to storage. Farr recommends that the motor and valve assembly be periodically removed, along with the top tong plate, so that guides, rollers and gears can be properly cleaned. Ensure that cleaning solvents and chemicals are captured to prevent environmental contamination, and dispose of all materials according to your company’s proscribed environmental protection regulations.

C. PREVENTIVE MAINTENANCE PRACTICES

Regular maintenance programs are necessary, and must be established to assure safe, dependable operation of your Hydraulic Tubular Connection System and to avoid costly breakdown maintenance. The following maintenance procedures provides information required to properly maintain your equipment. Your equipment may require more, or less maintenance depending upon the frequency of use and the field conditions under which your equipment operates. These maintenance procedures are designed for equipment operating at 10°C to 35°C ambient temperature for 10 hours per day. McCoy recommends that the inspection and maintenance procedures in this section be performed as recommended in the maintenance checklists (see Appendices), or in conjunction with your maintenance foreman’s experience and best estimate of when your equipment is due for this maintenance.

Purchased components included with your hydraulic tubular connection equipment (for example: motors, valves, etc.) may specify maintenance tasks and intervals over and above what McCoy recommends as part of their recommended procedures. Users of this equipment may choose to perform or ignore these additional tasks at their discretion.

Premature fouling of particulate filters within your prime mover or ancillary hydraulic power unit requires immediate hydraulic fluid laboratory analysis to prevent premature wear of hydraulic system due to high levels of wear metals in the fluid.

McCoy Completions & Drilling recommends tracking all maintenance activity including the lubrication schedule. This may be a simple as keeping a paper log, or using a software-based maintenance tracking utility. A maintenance log is a valuable tool that can be used for easily retrieving maintenance history or identifying trends that require correction.

D. LUBRICATION

Use a quality multipurpose bearing lubricant that will remain within its viscosity range at expected operating temperatures. In addition, FARR recommends the following lubrication procedure at the completion of each job prior to storage.

1. Cage Plate Guide Rings

Lubricate the guide rings through the grease fittings on the top and bottom cage plates, four on top and four on the bottom (See Illustration 3.D.1).

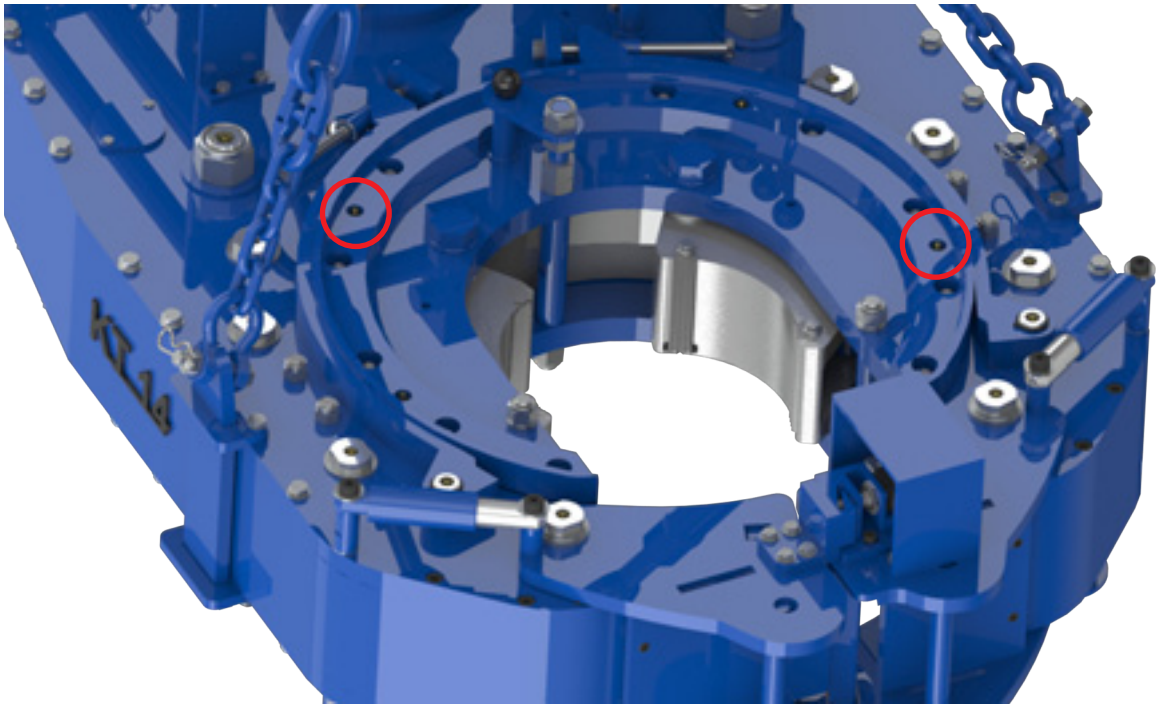

ILLUSTRATION 3.D.1: GUIDE RING LUBRICATION

2. Support Rollers

Apply grease to the support roller bearings through the grease fittings recessed into the top of each support roller shaft (12 locations total).

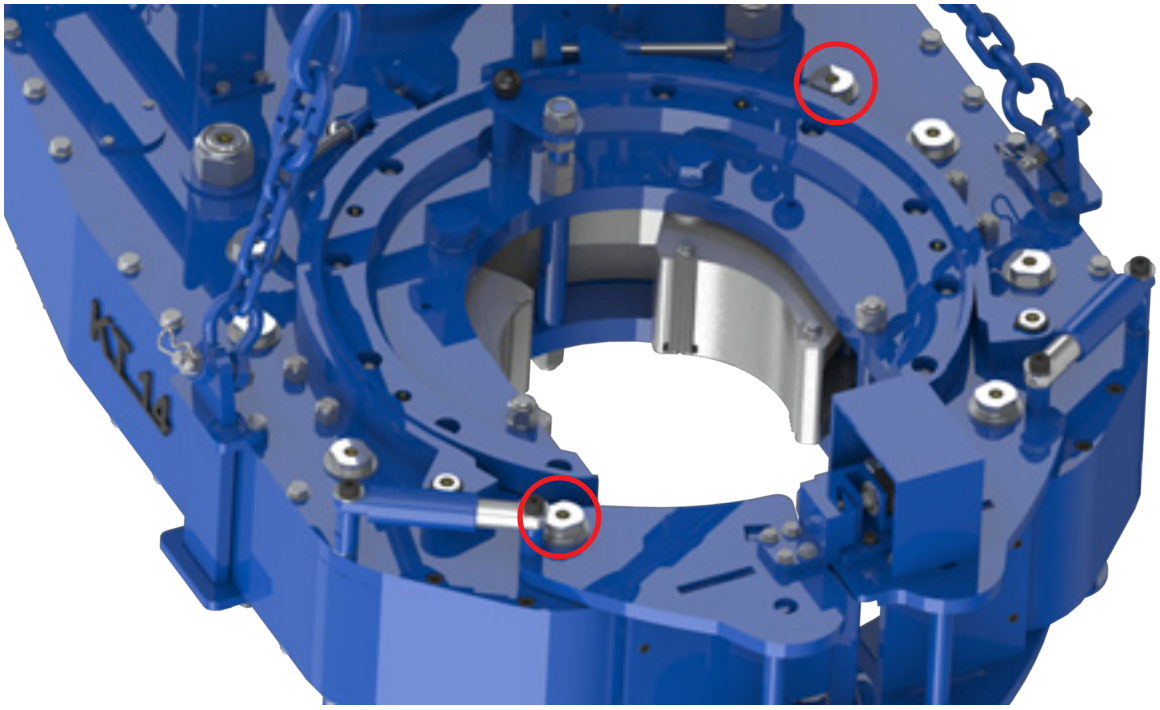

ILLUSTRATION 3.D.2: SUPPORT ROLLER LUBRICATION

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3. Rotary Idlers

Apply grease to the rotary idler bearings through the grease fittings recessed into the top of each shaft on the top face of the tong (two locations total).

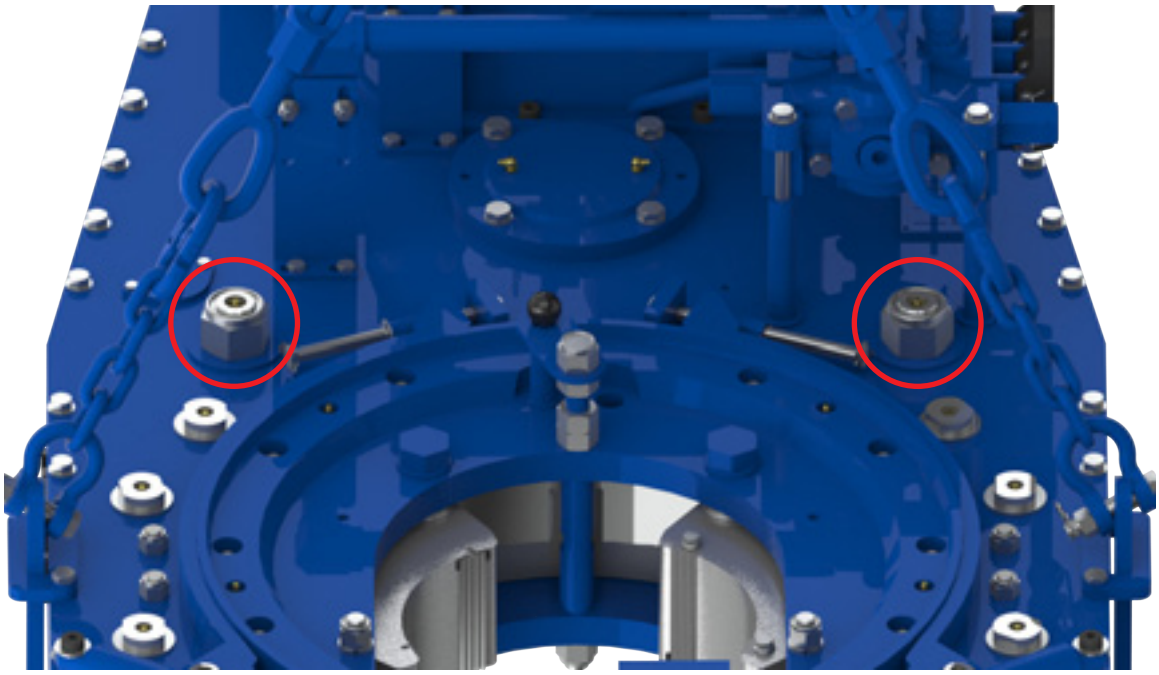

Illustration 3.D.3: Rotary Idler Lubrication

4. Pinion Idlers

Apply grease to the pinion idler bearing through the grease fitting recessed into the top of the half-shafts, located on the bottom face of the tong (two locations total).

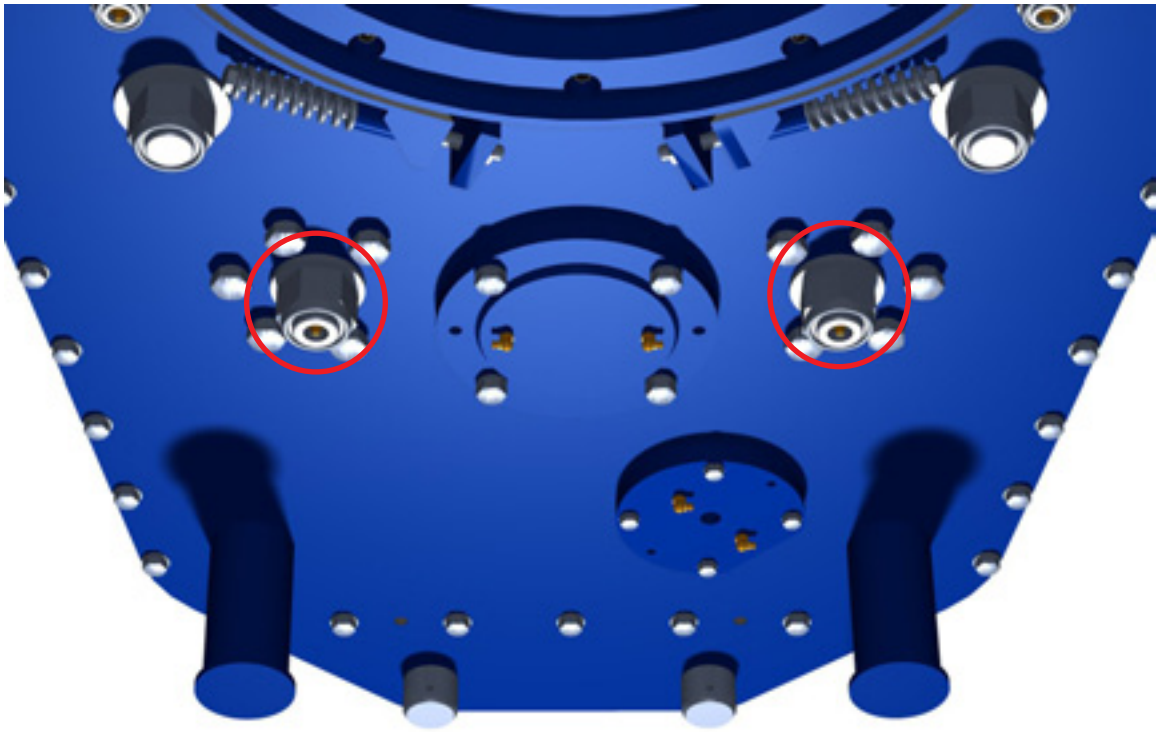

Illustration 3.D.4: Pinion Idler Lubrication

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5. Pinion

Apply grease to the pinion bearings through the grease fittings located on the bearing caps on the top and bottom faces of the tong (two locations top, two locations bottom).

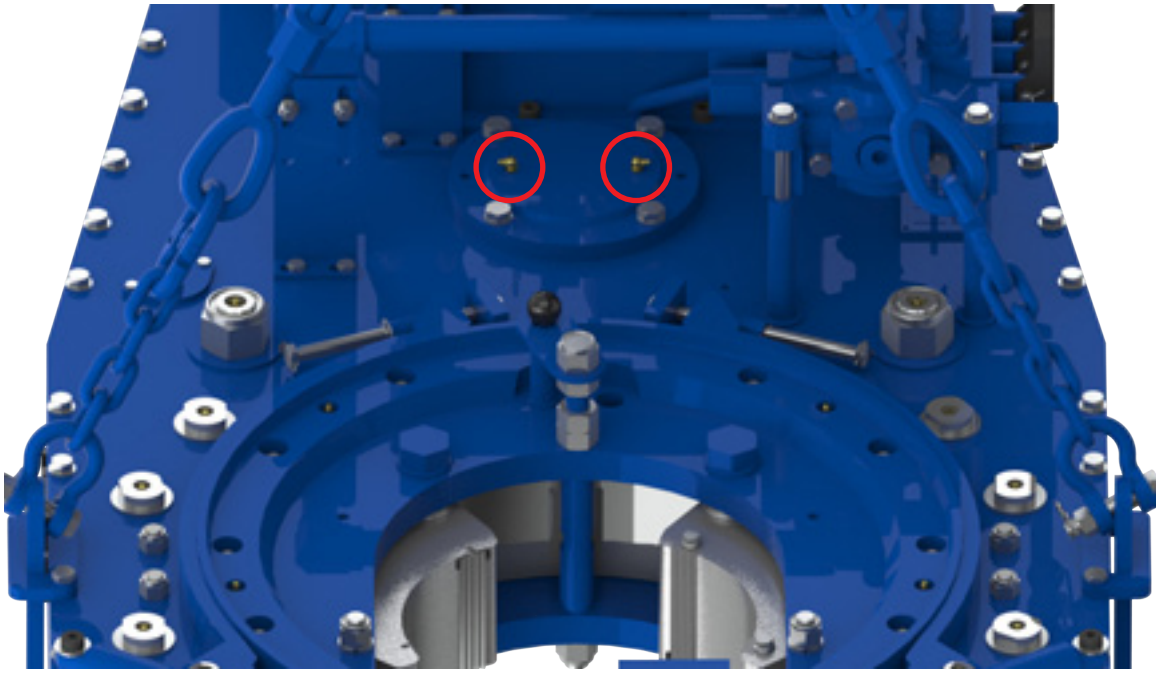

Illustration 3.D.5: Pinion Lubrication

6. Clutch

Apply grease to the clutch bearings through the two grease fittings located on the clutch bearing cap on the bottom face of the tong, and the single grease fitting recessed into the end of the clutch shaft. (three locations total). NOTE: A protective plug may have been inserted into the end of the clutch shaft over the grease fitting prior to shipping - this plug may be removed for normal operation.

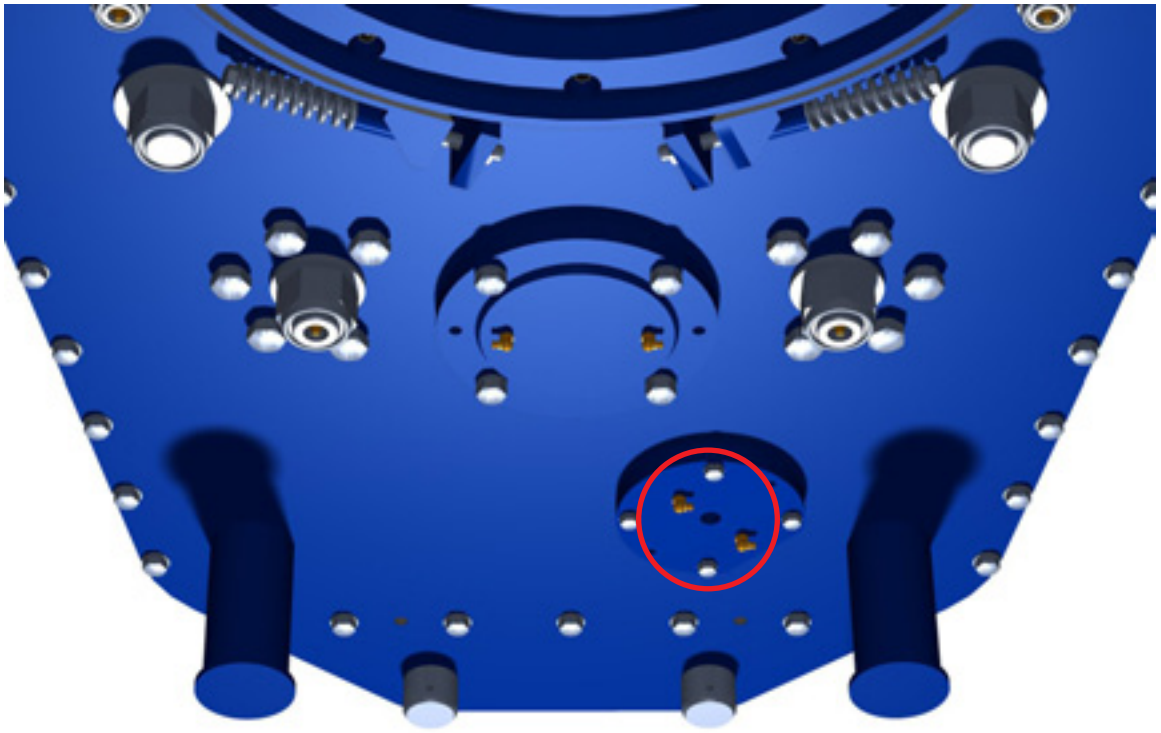

Illustration 3.D.6: Clutch Lubrication

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7. Motor Mount

Apply grease to the motor gear/clutch drive gear through the grease fitting located on the rear of the motor mount (two locations).

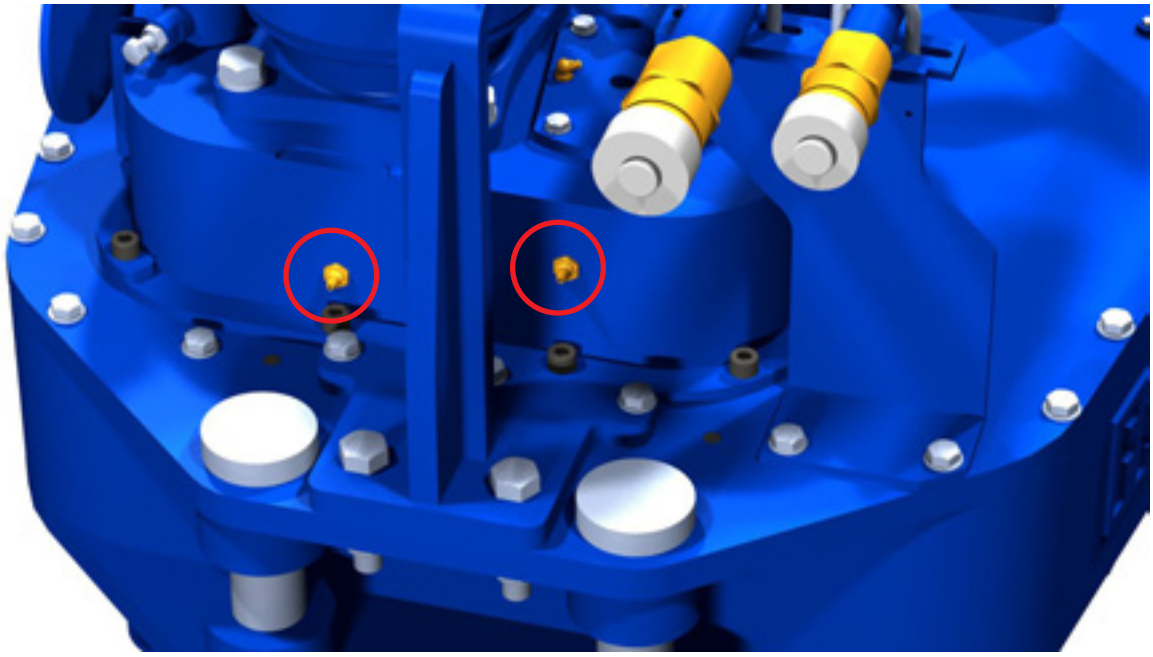

Illustration 3.D.7: Motor Mount Lubrication

8. Shifting Shaft

Apply grease to the shifting shaft and top shifting shaft bushing. The shaft and shifting yoke can be accessed through the cover plate on the side of the tong.

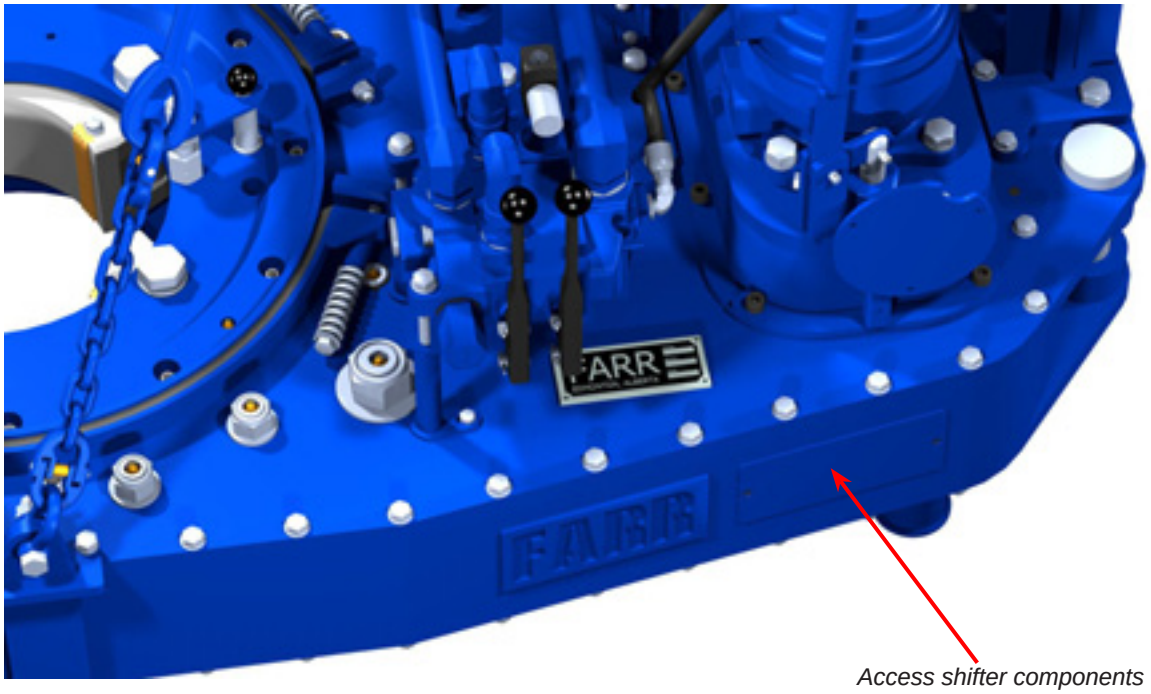

Illustration 3.D.8: Shifter Component Lubrication

9. Lay Gear Assembly

Apply grease to the door latch through the two grease fittings located in the bearing cap, and the one grease fitting in the end of the lay gear shaft. NOTE: A protective plug may have been insert-ed into the end of the lay shaft over the grease fitting prior to shipping - this plug may be removed for normal operation.

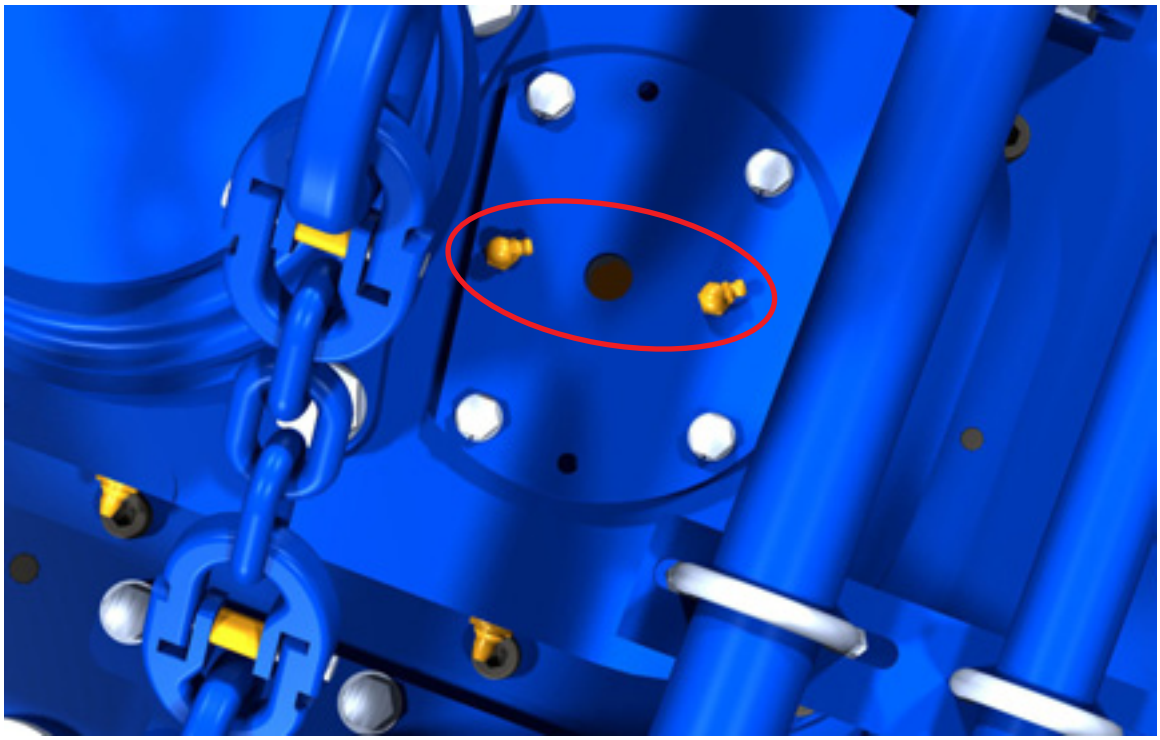

Illustration 3.D.9: Lay Gear Lubrication

10. Door Spring Cylinder

Periodically disassemble the door stop cylinders and coat the spring and cylinder with a general purpose lubricating oil.

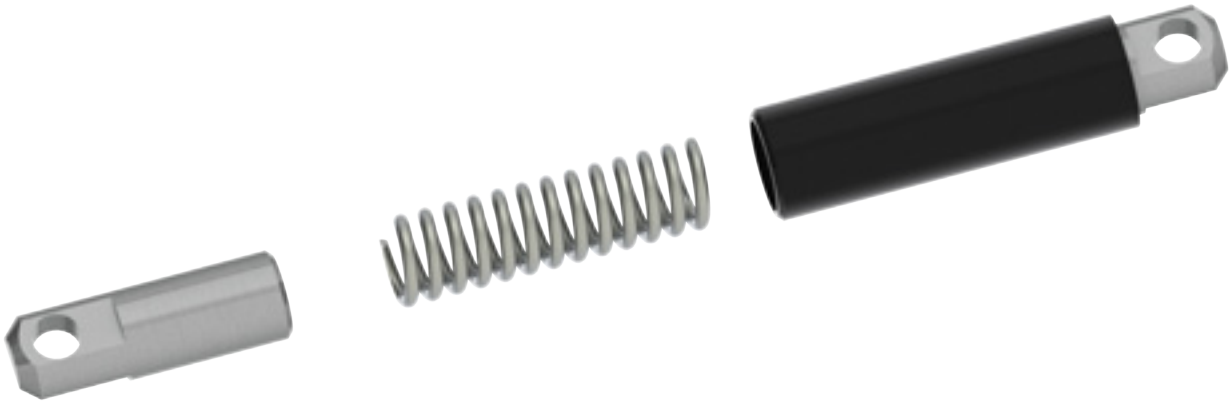

Illustration 3.D.10: Door Spring Cylinder (Exploded)

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Recommended lubrication amount at the completion of each job:

1.	Cage Plate Guide Rings (Upper and lower)	1 shot grease
2.	Rotary Roller Bearings (Upper and lower)	3 shots grease
3.	Rotary Idler Bearings	4 shots grease
4.	Pinion Idler Bearings	4 shots grease
5.	Pinion Bearings (Upper and lower)	2 shots grease
6.	Clutch Shaft Bearings	1 shot grease
7.	Motor Mount Housing	10 shots grease
8.	Shifting Shaft	as required
9.	Lay Gear	1 shot grease

Farr recommends that a liberal coating of grease be applied to the cam surface of the rotary drive gear prior to jaw installation. Also, the clutch inspection plate should periodically be removed, and a liberal coating of grease applied to the clutch, drive gears and shifting shaft.

E. ADJUSTMENTS

1. Brake Band Adjustment

The brake bands must be periodically adjusted to continue to provide smooth and efficient jaw cam action. Inadequate cage plate tension will allow the cage plate to rotate with the rotary gear, resulting in poor gripping of the pipe or casing due to improper “camming” action of the tong jaws. Tightening the brake band against the cage plates will increase frictional resistance, allowing jaws to cam properly and grip the casing. Adjust the brake band using the adjustment nut and bolt set as shown in the illustration below. Do not over-tighten, as this causes excessive wear to the brake bands. Ensure all four brake bands are adjusted simultaneously and equally.

TOP AND BOTTOM BRAKE BANDS MUST BE ADJUSTED SIMULTANEOUSLY AND EQUALLY

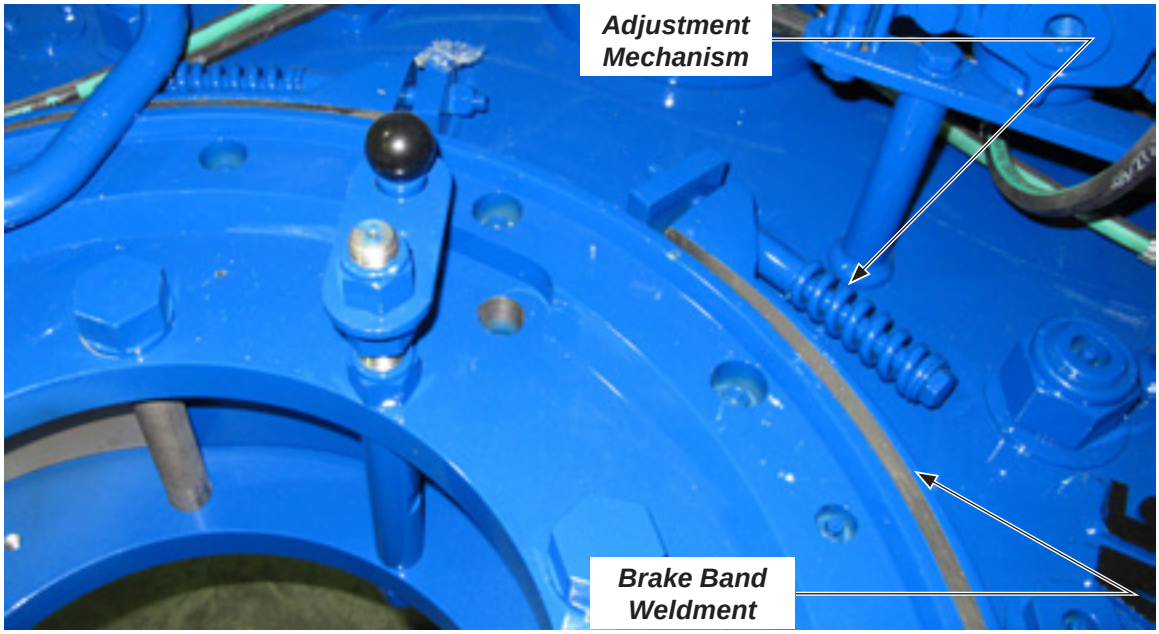

ILLUSTRATION 3.E.1: BRAKEBAND ADJUSTMENT

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2. Door Alignment

Over time the tong doors may become misaligned, which can result in symptoms such as binding during opening and closing, or the doors may not open or fully close.

THE DOOR IS AN IMPORTANT PART OF THE STRUCTURAL INTEGRITY OF THE TONG. IT IS IMPERATIVE TO KEEP A SECURE FIT AT THE DOOR IN ORDER TO MAINTAIN PROPER GEAR ALIGNMENT, AND TO MINIMIZE THE POSSIBILITY OF DAMAGE TO THE GEAR TRAIN WHEN OPERATING THE TONG AT SPECIFIED TORQUE. A CLOSED DOOR ALSO ENSURES SAFETY OF OPERATING PERSONNEL.

Each door weldment is equipped with two set screws, along with jam nuts to lock position, to align the door when it is in the closed position.

Note that some illustrations do not exactly represent your tong.

Align the doors using the following procedure:

i. Open both doors, and loosen the jam nuts locking the door position set screws inside the front plates of the door assemblies (see illustration 3.E.2) .

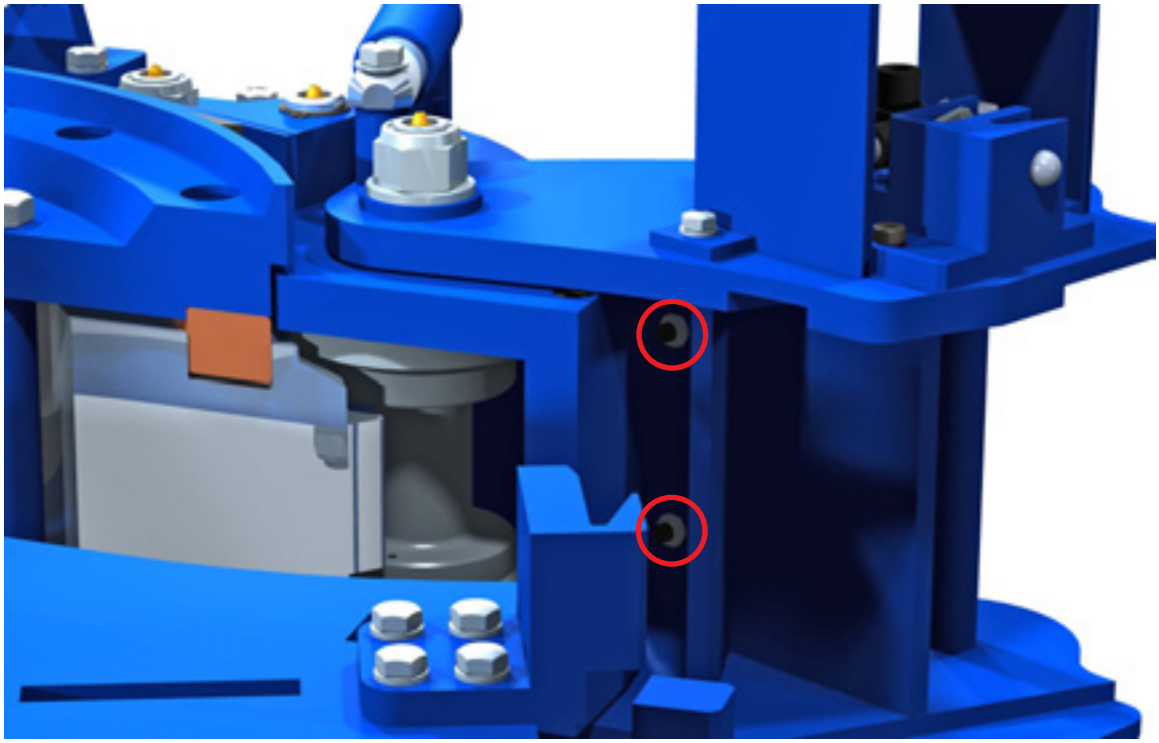

ILLUSTRATION 3.E.2: DOOR ALIGNMENT SET SCREWS

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Door Alignment Cont’d:

Close the LH tong door and, adjusting the set screws equally, adjust the door until it is perpendicular to the side body plate of the tong (see illustration 3.E.3).

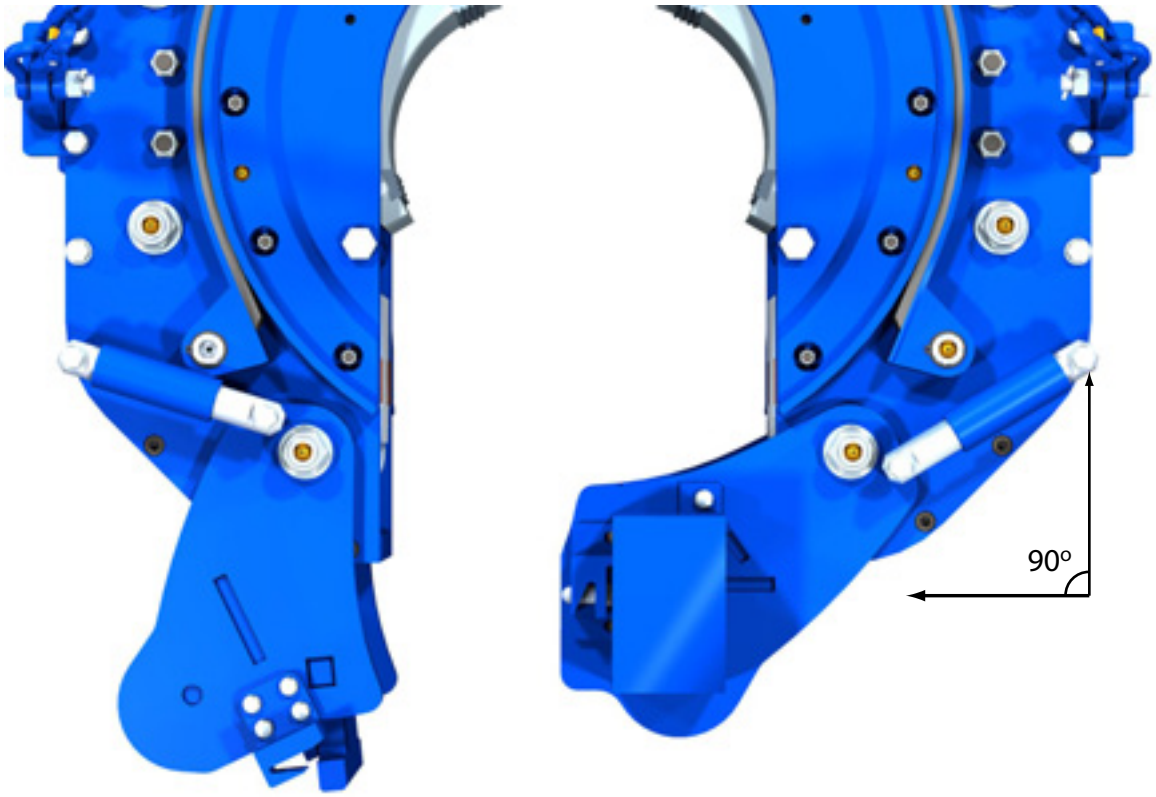

ILLUSTRATION 3.E.3: LH DOOR ALIGNMENT

Close the RH tong door and, adjusting the set screws equally, adjust the RH door until the it is aligned to the LH door adjusted in the previous step. The “tee tabs” on the RH door should centred within the locking slots on the LH door.

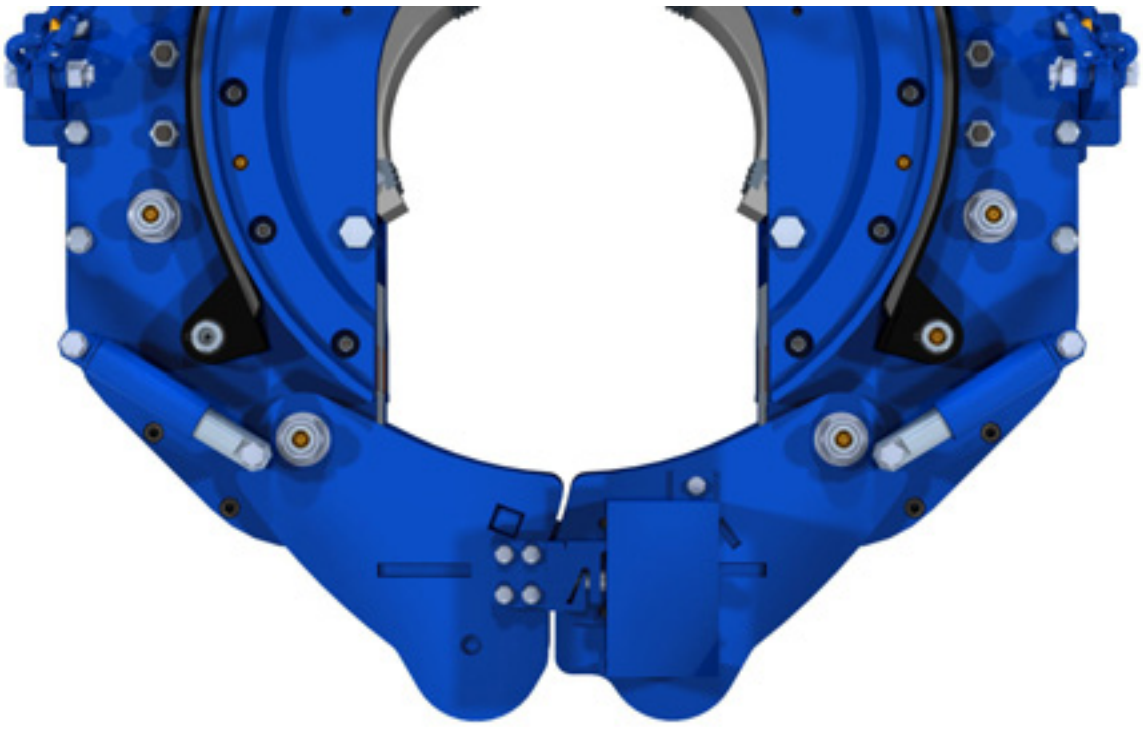

ILLUSTRATION 3.E.4: RH DOOR ALIGNMENT

Actuate the tong doors to ensure that there is no binding or other impediments to smooth operation. Grease the top and bottom “locking slots” on the door so that the tee tab on the RH door slides smoothly. If applicable, grease the safety door latch hooks. If the doors still bind once the alignment has been completed, the adjustment procedure may have to be repeated.

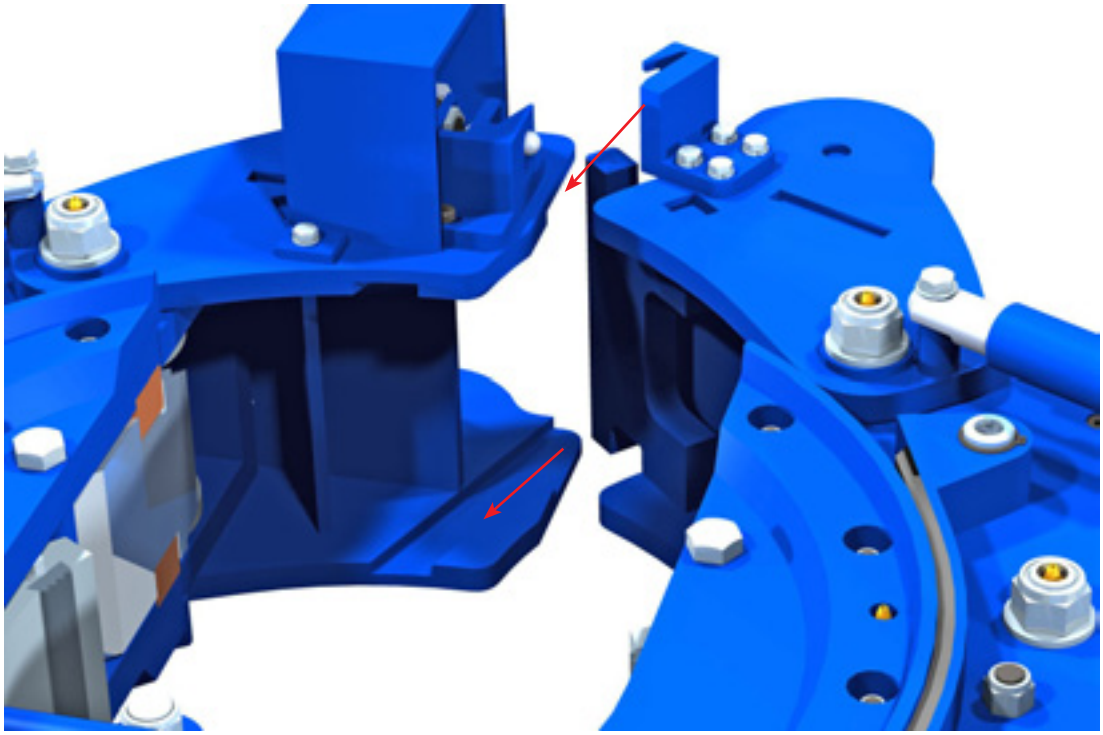

Illustration 3.E.5: Door Locking Slots

3. ***Shifter Detent Force Adjustment:***

Over time wear to the shifting shaft, wear to the detent balls, and loss of spring tension in the detent springs may result in a loose or “sloppy” fit within the top shifter bushing. The detent pressure may be increased or otherwise adjusted by loosening the 7/16” UNF locking jam nuts, and threading in the 7/16” UNF detent bolts to increase the spring force. Should adequate detent action not be achieved, the shifting shaft, detent balls, or detent springs (or possibly all three) may need to be replaced (see Pp. 5.28 - 5.29). NOTE: When adjusting detent spring force, ensure both detent spring assemblies are adjusted simultaneously and equally. Additionally, if the decision is made to replace detent springs and balls, ensure both sets are replaced at the same time.

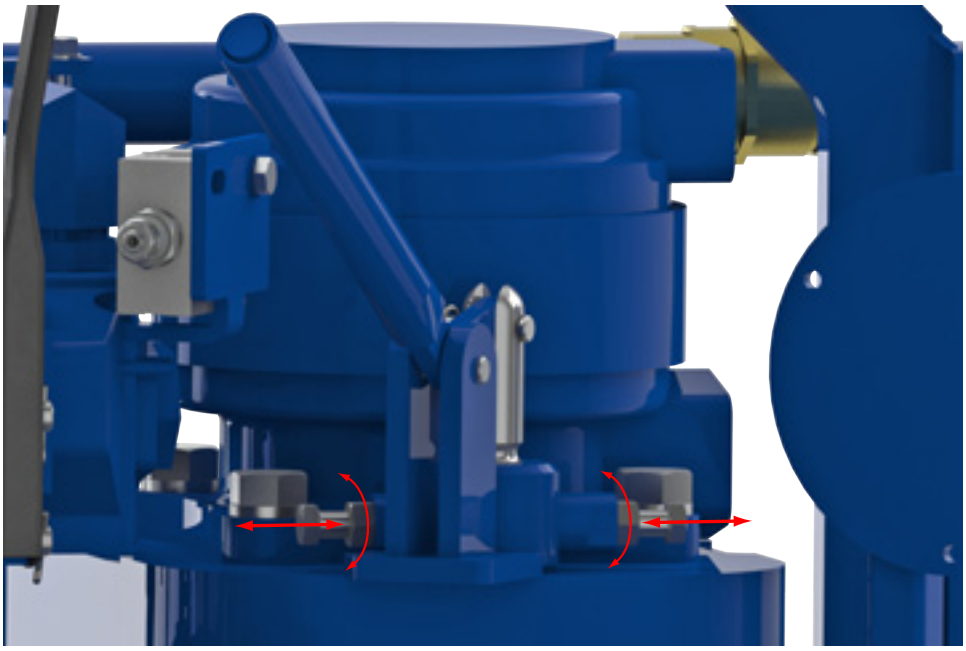

Illustration 3.E.6: Shifter Detent Force Adjustment

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F. RECOMMENDED PERIODIC CHECKS

1. Door Stop Springs

The springs inside the actuator cylinders must be of sufficient strength to enable the door latch mechanisms to snap closed properly, and to hold the doors in the open position when opened. Replace the latch spring inside the cylinder when this occurs.

2. Backing Pin

Perform a visual inspection of the backing pin after each job. Replace the pin if stress cracks or excessive wear is found, or if either pin is bent.

3. Shifting Shaft

The shifting yoke is secured to the shifting shaft by one hex jam nut above the shifting yoke, and one locknut on the bottom of the yoke. Check these nuts after each job. Do this by removing the clutch inspection plate and ensuring a snug fit prior to lubrication.

4. Torque Gauge Assembly

Periodic calibration of the torque gauge is recommended to assure accurate torque readings. When having the torque gauge serviced and calibrated, it is critical to note the arm length of the tong, as indicated in the “Specifications” section. Farr recommends that the torque gauge assembly be calibrated yearly. Periodically check to ensure the load cell is filled with oil (see Section 6).

G. OVERHAUL PROCEDURES

The tong may be overhauled following the disassembly instructions in the following procedure. Access to the gear train is possible by removing the top plate of the tong.

ALL MAINTENANCE AND OVERHAUL SHOULD BE PERFORMED FROM THE TOP. THE BOTTOM PLATE OF THE TONG IS TYPICALLY WELDED TO THE SIDE BODY AND CANNOT BE REMOVED.

REPLACEMENT FASTENERS (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) USED DURING MAINTENANCE OR OVERHAUL MUST BE GRADE 8 OR EQUIVALENT UNLESS OTHERWISE SPECIFIED.

REMOVAL OF TOP PLATE

1. *Ensure tong is well-supported from the bottom, using structure that will safely support the entire weight of the tong.*
2. *Support the chain sling with a crane; remove the chain sling assembly by disconnecting the shackles from the from the hanger brackets. Hang in a safe location free from potential of mechanical or corrosive damage.*
3. *If not already done remove jaw assemblies.*
4. *Disconnect the hydraulic connections to the motor. Disconnect the hydraulic connections from the safety door switch. Contain hydraulic fluid spilled from disconnected lines and dispose in accordance with your company’s environmental policies.*
5. *Undo the restraints securing the inlet and outlet lines connections to their supports, and use a crane to lift the hydraulic valve section away from the tong.*
6. *Remove the mounting posts for the valve bank. Remove the inlet and outlet support pieces and dump valve protector.*
7. *Remove the two front chain sling hanger brackets, and the rear chain sling hanger bracket.*
8. *Remove top brake band assemblies.*
9. *Remove the tong door spring cylinders.*
10. *Unscrew the two door cylinder mounting posts and set aside.*
11. *Remove door assemblies:*
    - *Remove the nylock nuts from the bottom of each door pivot roller shaft.*
    - *Ensure each door assembly is supported. Use a soft alloy material (e.g. brass rod, etc.), if necessary, to lightly tap each shaft through the support roller assembly until it comes free at the top. Use caution that the threads on the ends of the support roller shafts are not damaged.*
12. *Remove the torque gauge mount weldment from the top plate, directly behind the motor mount.*
13. *Remove the clevis pins securing the shifter handle weldment to the shifter shaft and lug weldment, and remove handle.*

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REMOVAL OF TOP PLATE (Continued):

14. *Remove the four hex head cap screws securing the motor to the motor mount , then lift the motor up and away from the motor mount. Inspect the motor gear, located at the bottom of the motor shaft, for gear clashing or tooth damage. Also, ensure that the motor gear is securely attached to the motor shaft.*
15. *Remove the four bolts securing the lay gear bearing cap, and pull the bearing cap straight up.*

IF THE BEARING REMAINS ATTACHED TO THE LAY GEAR SHAFT AFTER THE BEARING CAP IS PULLED, FARR CANADA CORP. SERVICE DEPARTMENT RECOMMENDS LEAVING IT IN PLACE UNTIL THE TOP TONG PLATE IS REMOVED.

16. *Back off the two shifter detent bolts until neither of the springs are placing any force on the shifter shaft.*
17. *Remove the access panel from the left rear side. Remove the nut securing the shifting shaft to the shifting fork. Remove the shifting shaft by rotating and pulling up through the shifting shaft bushings and the shifting fork.*
18. *Remove the eight hex socket head cap screws securing the motor mount to the top plate. Use care not to dislodge and lose the two positioning dowels as the motor mount is lifted away from the top plate.*
19. *Pull the lay gear stack straight up and out of the lower lay gear bearing, which may remain pressed into the top plate. Ensure the bottom spacer remains with the gear stack.*
20. *Remove the clutch shaft plate and the 1/2” flat head screw securing the clutch drive gear to the top of the clutch shaft. Carefully remove the drive gear from the clutch shaft. Do not lose the two drive gear keys.*
21. *Remove the four 3/8” hex flat head cap screws securing the top clutch bearing plate to the top plate. Remove the top clutch bearing plate and the top clutch shaft spacer, and bearing retainer spacer.*
22. *Pull the top pinion gear bearing cap by removing the four 1/2” bolts which secure the bearing cap. Thread two of the removed bolts into the extra holes on top of the bearing cap, and use them to press the bearing cap out of place.*

IF THE BEARING REMAINS ATTACHED TO THE PINION GEAR SHAFT AFTER THE BEARING CAP IS PULLED, FARR CANADA CORP. SERVICE DEPARTMENT RECOMMENDS LEAVING IT IN PLACE UNTIL THE TOP TONG PLATE IS REMOVED.

THE CAGE PLATE BOLTS ARE THE ONLY ITEMS FASTENING THE BOTTOM CAGE PLATE TO THE TONG. SUPPORT THE BOTTOM CAGE PLATE FROM BELOW PRIOR TO REMOVING CAGE PLATE BOLTS IN ORDER TO PREVENT DAMAGE TO THE BOTTOM CAGE PLATE OR PERSONAL INJURY TO THE MECHANIC

23. *Ensure the bottom cage plate is supported. Remove the backing pin assembly and the two front cage plate bolt and nut sets. Remove the rear cage plate bolt as the two cage plates are freed. Do not damage the manganese bronze guide rings, which are mounted to the cage plates.*
24. *Remove the top nuts and washers for the rotary idler gears.*
25. *Remove the remaining support roller shaft nuts. If necessary use a soft alloy material (e.g. brass rod, etc.) to lightly tap the support roller shafts up through the support roller assemblies until they are free of the top plate.*
26. *Remove the hex head bolts and hex socket head cap screws around the perimeter of the tong that secure the top plate weldment to the side body.*
28. *With all the above steps taken, the top tong plate weldment can be lifted off providing access to the inside of the gear case.*

LIFT THE TOP PLATE STRAIGHT UP TO AVOID SNAPPING THE DOWEL PINS. A SNAPPED OR OTHERWISE DAMAGED DOWEL PIN CAN BE EXTREMELY DIFFICULT TO REMOVE

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H. ASSEMBLY PROCEDURES

Assembly of McCoy Drilling & Completion Hydraulic Power Tongs is simple, and can be accomplished without the use of special tools. The instructions on this page are presented as a guide only, and are similar to the assembly sequence our technician would use while assembling the tong in our plant.

TIGHTENING TORQUE GUIDE			
SAE GRADE 8 - FINE THREAD			
SIZE	CLAMP LOAD	PLAIN	PLATED
1/4 - 28 (.250)	3,263	14 ft. lbs.	10 ft. lbs.
5/16- 24 (.3125)	5,113	27 ft. lbs.	20 ft. lbs.
3/8 - 24 (.375)	7,875	49 ft. lbs.	37 ft. lbs.
7/16 - 20 (.4375)	10,650	78 ft. lbs.	58 ft. lbs.
1/2 - 20 (.500)	14,400	120 ft. lbs.	90 ft. lbs.
9/16 - 18 (.5625)	18,300	172 ft. lbs.	129 ft. lbs.
5/8” - 18 (.625)	23,025	240 ft. lbs.	180 ft. lbs.
3/4 - 16 (.750)	33,600	420 ft. lbs.	315 ft. lbs.
7/8” - 14 (.875)	45,825	668 ft. lbs.	501 ft. lbs.
1 - 12 (1.000)	59,700	995 ft. lbs.	746 ft. lbs.
1 - 14 (1.000)	61,125	1019 ft. lbs.	764 ft. lbs.
1 1/8 - 12 (1.125)	77,025	1444 ft. lbs.	1083 ft. lbs.
1 1/4 - 12 (1.125)	96,600	2012 ft. lbs.	1509 ft. lbs.
1 3/8 - 12 (1.375)	118,350	2712 ft. lbs.	2034 ft. lbs.
1 1/2 - 12 (1.500)	142,275	3557 ft. lbs.	2668 ft. lbs.
SAE GRADE 8 - COARSE THREAD			
SIZE	CLAMP LOAD	PLAIN	PLATED
1/4 - 20 (.250)	2,850	12 ft. lbs.	9 ft. lbs.
5/16- 18 (.3125)	4,725	25 ft. lbs.	18 ft. lbs.
3/8 - 16 (.375)	6,975	44 ft. lbs.	33 ft. lbs.
7/16 - 14 (.4375)	9,600	70 ft. lbs.	52 ft. lbs.
1/2 - 13 (.500)	12,750	106 ft. lbs.	80 ft. lbs.
9/16 - 12 (.5625)	16,350	153 ft. lbs.	115 ft. lbs.
5/8” - 11 (.625)	20,325	212 ft. lbs.	159 ft. lbs.
3/4 - 10 (.750)	30,075	376 ft. lbs.	282 ft. lbs.
7/8” - 9 (.875)	41,550	606 ft. lbs.	454 ft. lbs.
1 - 8 (1.000)	54,525	909 ft. lbs.	682 ft. lbs.
1 1/8 - 7 (1.125)	68,700	1288 ft. lbs.	966 ft. lbs.
1 1/4 - 7 (1.125)	87,225	1817 ft. lbs.	1363 ft. lbs.
1 3/8 - 6 (1.375)	103,950	2382 ft. lbs.	1787 ft. lbs.
1 1/2 - 6 (1.500)	126,450	3161 ft. lbs.	2371 ft. lbs.

ALL FASTENERS USED DURING REASSEMBLY OF LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS) MUST BE TIGHTENED TO THE CORRECT TORQUE. THREADED FASTENERS USED IN LOAD-BEARING DEVICES MUST BE SECURED WITH RED LOCTITE™. CHECK ALL CHAINS FOR DAMAGE BEFORE PLACING UNDER LOAD. DO NOT ALLOW CHAINS TO KINK BEFORE PLACING UNDER LOAD.

MECHANICAL **ASSEMBLY SEQUENCE:**

APPLY A THIN LAYER OF GREASE TO THE SURFACE OF EACH MOVING PART DURING ASSEMBLY TO AID IN THE ASSEMBLY PROCESS.

1. *Position the tong body gear case on a suitable stationary support such that the bottom body plate is accessible.*
2. *Press pinion bearing (PN 1393-93) into bottom pinion bearing cap (PN 1393-89A) and install bearing cap into bottom plate of tong. Secure with four 1/2” NC x 1-1/2” hex bolts and 1/2” lock washers.*
3. *Press lower clutch bearing (PN 1393-55) into clutch bearing cap (PN 1393-54) and install bearing cap into bottom plate of tong. Secure with four 3/8” NC x 1-3/4” hex bolts and 3/8” lock washers.*
4. *Install two support segments (PN 1393-141) into the bottom plate and secure each with two 3/4” x 1-3/4” shoulder bolts and 5/8” NC hex nylock nuts.*
5. *Assemble main support roller assemblies (see Pp. 5.6 - 5.17 for exploded views of support roller assemblies):*
   - i. *Insert an inner support roller spacer (PN 1393-134) into the centre of each support roller “dumbbell” (PN 1393-135A (x6) and PN 1393-135 (x6)), 12 total.*
   - ii. *Press a support roller bearing (PN 1393-136) into each end of the support roller dumbbells, 24 bearings total.*
   - iii. *Slide a support roller spacer (PN 1393-140) on to six support roller shafts (PN 101-3945). Slide the shaft through five of the support roller assemblies that use the 1393-135A dumbbell, and one of the support roller assemblies that use the 1393-135 dumbbell.*
   - iv. *Slide both brakeband support roller shafts (PN 1393-131-02) through support roller assemblies that use the 1393-135 dumbbell and centre as well as possible. Place a support roller spacer (PN 1393-140) over each end of the brakeband support roller shafts.*
   - v. *Slide a low-profile support roller shaft (PN 1393-131-01) through a support roller assembly that uses the 1393-135A dumbbell, and slide the second low-profile support roller shaft through a support roller assembly that uses the 1393-135 dumbbell. Centre both shafts as well as possible. Place a support roller spacer (PN 1393-140) over each end of the low-profile support roller shafts.*
   - vi. *If not already done, ensure the second support roller spacers have been placed over the ends of the shafts installed in Step 5(iii).*
6. *Install four support roller assemblies along one side of the body case - see Pp. 5.4 - 5.5 for a support roller placement guide, and refer to illustration 3.H.1.*

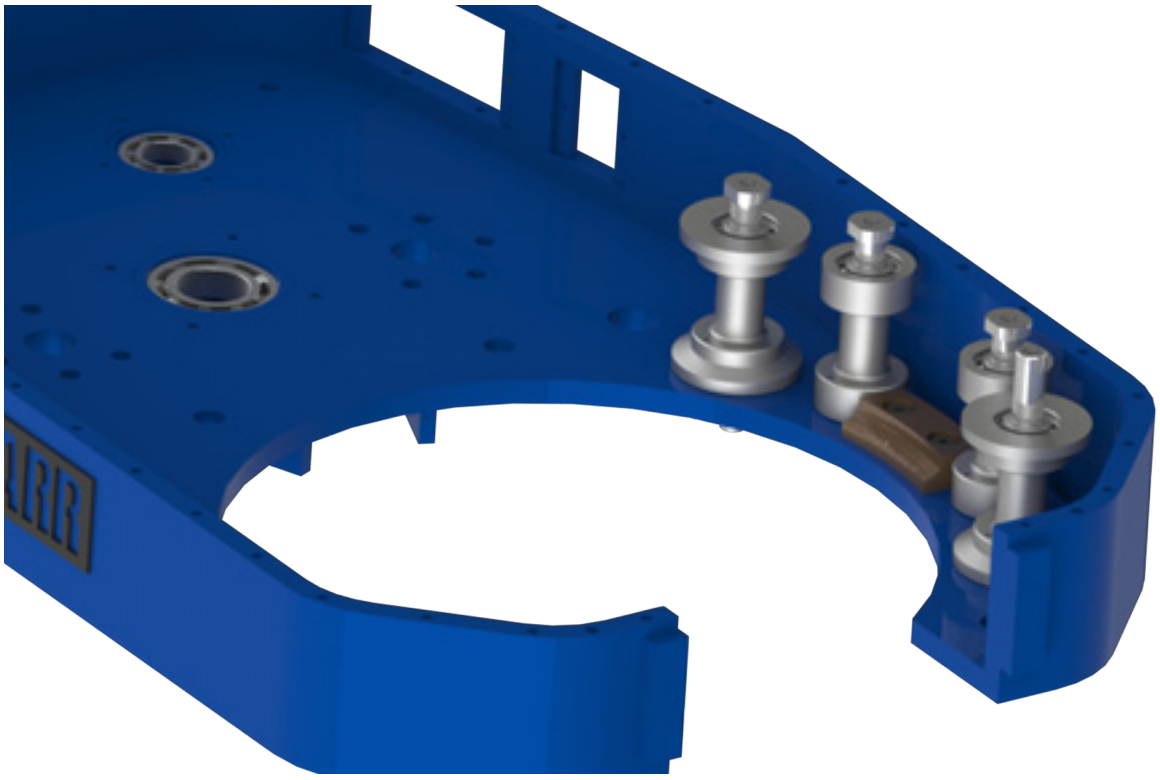

ILLUSTRATION 3.H.1: INITIAL SUPPORT ROLLER PLACEMENT - ROTARY GEAR INSTALLATION

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Assembly Procedures (Continued):

7. *Install rotary gear (PN 1393-1), making sure the backing pin slots are on the side facing up. Ensure one side is supported by the support rollers installed in Step 6, and have the opening in the rotary gear oriented as shown in illustration 3.H.2.*

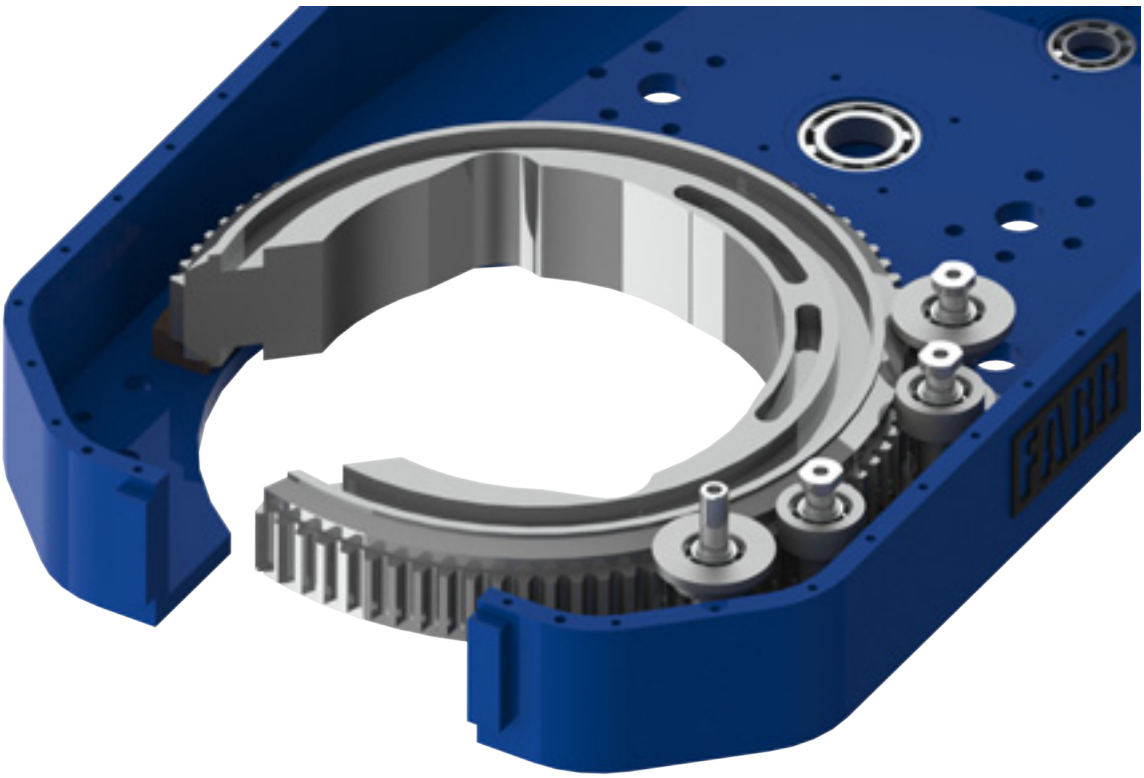

Illustration 3.H.2: Rotary Gear Installation

8. *Install support roller assemblies in the locations exposed by the opening in the rotary gear. Continue to rotate the rotary gear, installing support roller assemblies in the rotary gear opening as it is rotated. Finish with the rotary gear aligned with the opening in the bottom plate. Do not install the two door pivot support roller assemblies at this time.*
9. *Press an idler bearing (PN 1393-106) into each rotary idler gear (PN 1393-119) and press against inside lip of the gear.*
10. *Slide an outer spacer (PN 1393-109) into each gear and press against the bearings installed in Step 9.*
11. *Place an inner spacer (PN 1393-108) onto each bearing installed in Step 9, centering over the bearings.*
12. *Slide a second idler bearing into each rotary idler gear. Secure bearings with retainer rings (PN 1393-110).*
13. *Place a rotary idler spacer (PN 1393-121) over the respective rotary idler locations in the bottom plate.*
13. *Check to ensure the inner spacers installed in Step 11 are centered in the gear/bearing assemblies. One at a time, place each gear/bearing assembly in its location between the two support rollers, over the rotary idler spacers and meshed with the rotary gear (see Illustration 3.H.3).*

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Assembly Procedures (Continued):

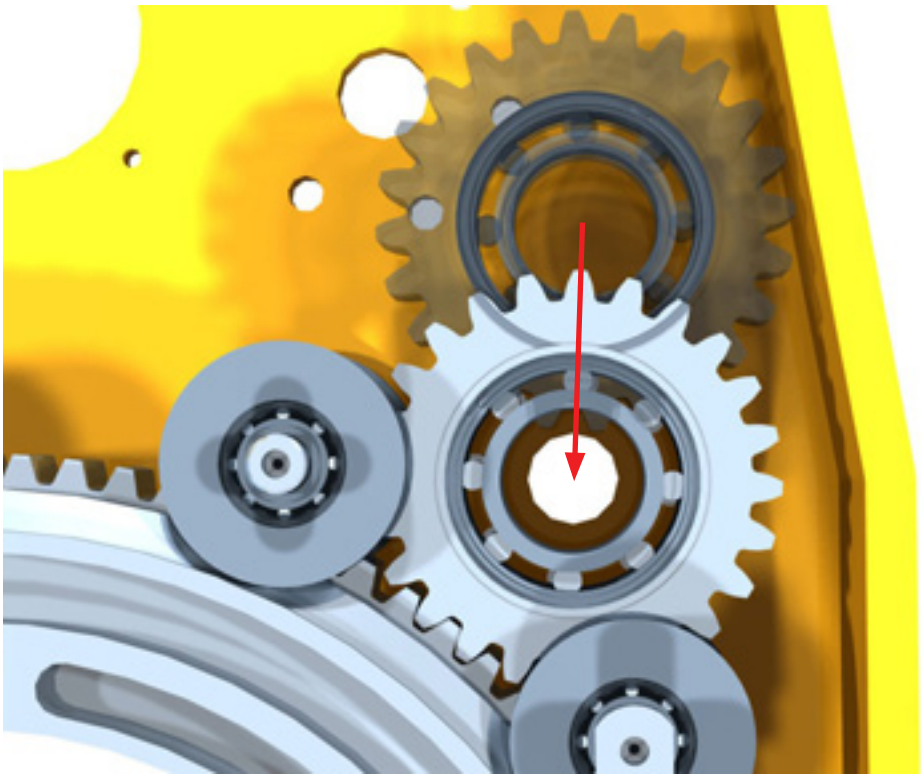

ILLUSTRATION 3.H.3: IDLER GEAR INSTALLATION

14. *Insert the rotary idler shafts (1393-117) into each gear/bearing assembly.* ***ASSEMBLY NOTE:*** *Ensure that the shafts are oriented so that the machined ports for the grease fittings are “up” and flat ends of the shafts are “down”. Center the shaft within the gear, and secure the bottom of each shaft with 1-1/2” flat washers and 1-1/2” UNF hex nylock nuts. Slide a second idler gear spacer over the tops of each idler shaft to rest against the gear/bearing assemblies.*
15. *Slide the high pinion gear (PN 1393-87) over the end of the pinion gear shaft (PN 1393-86), ensuring that the “shoulder” on the high pinion gear is oriented to contact the center gear on the pinion gear shaft. Note that the pinion gear shaft is machined to exactly fit the high and low pinion gears.*
16. *Slide a pinion gear spacer (PN 1393-94) over the bottom end of the pinion gear shaft, oriented so the inner “shoulder” on the spacer faces toward the high pinion gear and the outer “shoulder” faces the end of the shaft. Place the end of the pinion gear shaft into the pinion bearing installed in Step 2, oriented so that the high pinion gear installed in the previous step is “down”.*
17. *Insert an idler bearing (PN 1393-106) into each pinion idler gear (PN 1393-120) and press against the inner lip of the gear, followed by a second idler bearing. Secure the idler bearings in the gear using a retainer (PN 1393-110).*
18. *Insert the pinion idler half-shafts (PN 1393-105) into the gear/bearing assemblies from the side of the gears that have the machined shoulder. Press the half-shafts through the bearings until the flange of the half-shaft is pressed against the gear shoulder. Secure the half-shafts in the gear/bearing assemblies using external retainer rings (PN 1374-110).*
19. *Place the ends of the pinion idler half-shafts through the bottom plate in their respective locations, meshing the pinion idler gears with the rotary idler gears and the pinion gear. Secure each half-shaft with five 3/4” NC x 2” hex bolts and 3/4” lock washers. Place a 1-1/2” regular flat washer over the end of each half-shaft and secure with 1-1/2” UNF hex nylock nuts.*
20. *Slide two needle bearings (PN 1393-53) over the bottom end of the clutch shaft (PN 1393-50) and press against center gear.* ***ASSEMBLY NOTE:*** *The “bottom” end of the clutch shaft has a recessed threaded port for a grease fitting.*
21. *Slide the high clutch gear (PN 1393-51) over the bottom of the clutch shaft on to the needle bearings, with the gear oriented so that the smaller diameter portion of the gear presses against the center gear on the clutch shaft.*
22. *Slide clutch shaft spacer (PN 1393-50-02) over the bottom end of the clutch shaft. Orient the spacer so that the “shoulder” faces toward the center of the clutch shaft. Place lower end of clutch shaft into the lower clutch bearing that was installed in Step 3.*
23. *Install shifting collar (PN 1393-62) over the top of the clutch shaft and mesh with the centre clutch gear.*
24. *Slide a third needle bearing over the top of the clutch shaft and press against center gear, followed by the inner spacer (PN 1393-52-01) and a fourth needle bearing. Ensure all three items are pressed firmly against the center gear on the clutch shaft.*

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Assembly Procedures (Continued):

25. *Slide the low clutch gear (PN 1393-52) over the top of the clutch shaft and seat on remaining two needle bearings. Ensure the gear is oriented so that the smaller diameter section is in contact with the center gear on the clutch shaft. Slide clutch shaft spacer (PN 1393-50-01) over the end of the clutch gear shaft and press against the low clutch gear.*
26. *Place the shifting fork weldment (PN 1393-72) roughly in its final position, meshed with the shifting collar.*
27. *Install the low pinion gear (PN 1393-88) over the end of the pinion gear and mesh with the low clutch gear. One side of this gear is machined with a small “shoulder”, and this shoulder must face toward the center gear on the pinion shaft. Slide the second pinion gear spacer (PN 1393-94) over the top end of the pinion gear, oriented so the inner “shoulder” on the spacer faces toward the low pinion gear and the outer “shoulder” faces the end of the shaft.*
28. *Install two cage plate support segments (PN 1393-141) onto the inside of the top plate and secure with 3/4” x 1-3/4” shoulder bolts and 5/8” NC nylock nuts.*
29. *Six of the support roller assemblies around the rotary gear use “shouldered” shafts. Carefully remove these shafts from these six support roller assemblies, taking care not to dislodge the remaining support roller assembly components supporting the rotary gear. The un-shouldered shafts in the remaining four assemblies may stay in place.*
30. *Place four 1/2” x 1-1/2” locating dowels in the undrilled holes around the perimeter of the side body weldment.*
31. *Position the top plate in its proper location. Use caution not to damage threads or retaining ring grooves when aligning the top plate with the rotary idler and remaining support roller shafts. The plate may need to be tapped onto the dowel pins. Secure the perimeter of the top plate with six 1/2” NC x 2” hex socket cap screws (locations shown circled in red in illustration 3.H.4) and twenty 1/2” NC x 2-1/2” hex bolts and 1/2” lock washers as shown in illustration 3.H.4.*

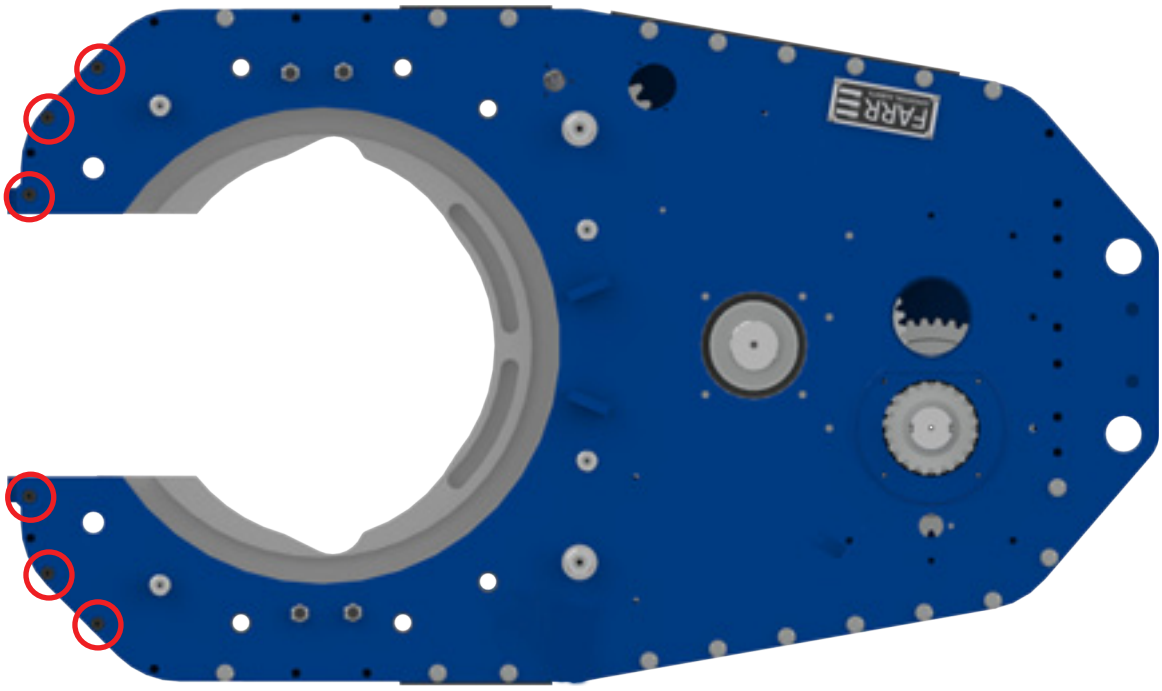

Illustration 3.H.4: Top Plate Fasteners

32. *Slide a 1-1/8” narrow flat washer over each of the six shouldered support roller shafts removed in Step 31, and re-insert the shafts into the six remaining support roller assemblies. Secure the shafts on the bottom with 1” narrow flat washers and 1” UNS thin nylock nuts.*
33. *Secure the two rear “low-profile” support roller shafts with an external retaining ring (PN 1429-131-04) at each end. The shafts may have to be tapped slightly to exactly center them between the top and bottom plate.*
34. *Slide the top clutch bearing (PN 1393-56) over the top of the clutch shaft and press against the top clutch shaft spacer. Secure the bearing using the clutch bearing plate (PN 1393-57) and four 3/8” NC x 1” hex socket flathead counter-sunk cap screws. ASSEMBLY NOTE: Ensure the flat on the bearing plate is aligned with the flat on the boss welded to the top plate.*
35. *Press the top pinion bearing (PN 1393-93) into the top pinion bearing cap (PN 1393-89). Install the bearing cap and bearing onto the top of the pinion shaft, with the flat on the bearing cap facing toward the rear of the tong. Secure to the top plate with four 1/2” UNC x 1-1/2” hex bolts and 1/2” lock washers.*
36. *Secure the top ends of the rotary idler shafts with 1-1/2” flatwashers and 1-1/2” UNF hex nylock nuts.*
37. *Press the lower lay gear bearing (PN 1393-152) into the top plate next to the clutch assembly.*

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Assembly Procedures (Continued):

38. *Insert the two lay shaft gear keys (PN 50-1220-3000) into their slots on the lay shaft (PN 1393-82). Press the lay shaft pinion gear (PN 1393-80) onto the shaft, over the keys all the way to the small shoulder on the lay shaft.*
39. *Slide the bottom spacer (PN 1393-82-04) over the bottom of the lay shaft next to the gear installed in Step 40. The spacer must be oriented so that the “inner shoulder” faces toward the gear and the “outer shoulder” faces the end of the shaft. Slide the bottom of the shaft into the bearing installed in Step 37.*
40. *Slide the the clutch shaft spacer (PN 1393-50-03) over the end of the end of the clutch shaft and press against the bearing. Ensure the spacer is oriented so that the single “inner shoulder” is facing the top end of the clutch shaft.*
41. *Insert the clutch drive gear shaft keys (PN 101-1947) into the clutch shaft. Slide the clutch drive gear (PN 1393-61) over the end of the clutch shaft and mesh with the lay pinion gear. Secure the clutch drive gear with the clutch shaft plate (PN 1393-50-04) and a 1/4” NC x 1” flat head countersunk machine screw.*
42. *Slide the lay shaft gear (PN 1393-81) onto the lay gear shaft. Slide the lay shaft spacer (PN 1393-82-03) over the end of the lay shaft and press against the lay shaft gear.*
43. *Place the lower shifter bushing (PN 1393-78) into its location in the top plate next to the clutch assembly. Secure in place using a 3/8” NC x 1” hex socket thin head cap screw.*
44. *Press two 3/8” x 1-1/4” dowel pins into the top plate to position the motor mount weldment, one beside the clutch assembly and one beside the lay gear assembly.*
45. *Lower the motor mount weldment (PN 101-5001) evenly over the dowel pins to avoid binding. Secure the motor mount to the top plate using eight 1/2” NC x 1-1/4” hex socket head cap screws. Use the two cap screws on the left side of the motor mount (as seen from the rear) to secure the torque gauge mount weldment (PN 101-1621) to the base of the motor mount.*
46. *Press the top lay shaft bearing (PN 1393-151-04) into the lay shaft bearing cap (PN 1393-151). Secure bearing cap to the top plate of the motor mount using four 3/8” UNC x 1” hex cap screws and 3/8” lock washers - ensure the flat on the bearing cap is oriented toward the cutout for the motor.*
47. *Thread two shifter detent tubes (PN 101-1497) into the top shifter bushing on the motor mount next to the shifter lug weldment.* ***ASSEMBLY NOTE:*** *Use red Loctite on the shifter detent tube threads.*
48. *Lightly grease the shifting shaft (PN 1393-71). Insert it through the top shifter bushing, and rotate it while pushing down through the lower shifter bushing until the threads on the end of the shaft are through the shifting fork.*
49. *Securely fasten the shifting fork to the shifting shaft using a 3/4” UNC thin nylock nut.*
50. *Insert a shifter detent ball (PN 02-0018) into each detent tube followed by a detent spring (PN 997-0-64). Thread a 7/16” UNF hex jam nut on to a 7/16” UNF x 1-1/4” hex bolt, and thread the hex bolt in to one of the detent tubes. Repeat the procedure with a second nut and bolt, and thread into the second detent tube.*
51. *Press the motor gear key (101-3596) into the shaft of the hydraulic motor (PN 87-0130). Slide the motor gear (PN 1393-149) over the shaft and key and secure in place with two 1/4” UNC x 3/8” hex socket set screws.*
52. *Secure the motor to the motor mount using four 3/4” UNC x 1-3/4” hex cap screws and 1/2” lock washers. Ensure the hydraulic ports on the motor face toward the front of the tong.*
53. *Attach shifting handle weldment (PN 101-) to the shifter shaft and pivot arms using two 3/8” x 1-1/2” clevis pins - secure the pins with cotter pins.*
54. *Attach a support ring (PN 1393-23) to the inside of the top cage plate (PN 1393-21) using eleven 1/2” x 1-3/4” shoulder bolts and 3/8” UNC nylock nuts.*
55. *Attach a support ring to the inside of the bottom cage plate (PN 1393-22) using eleven 1/2” x 1-3/4” shoulder bolts and 3/8” UNC nylock nuts.*
56. *Secure two cage plate spacers (PN 101-3630) and the rear cage plate bolt (PN 1393-36) to the bottom cage plate using 3/4” narrow flat washers and 3/4” UNC nylock nuts (see illustration 3.H.5).*

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Assembly Procedures (Continued):

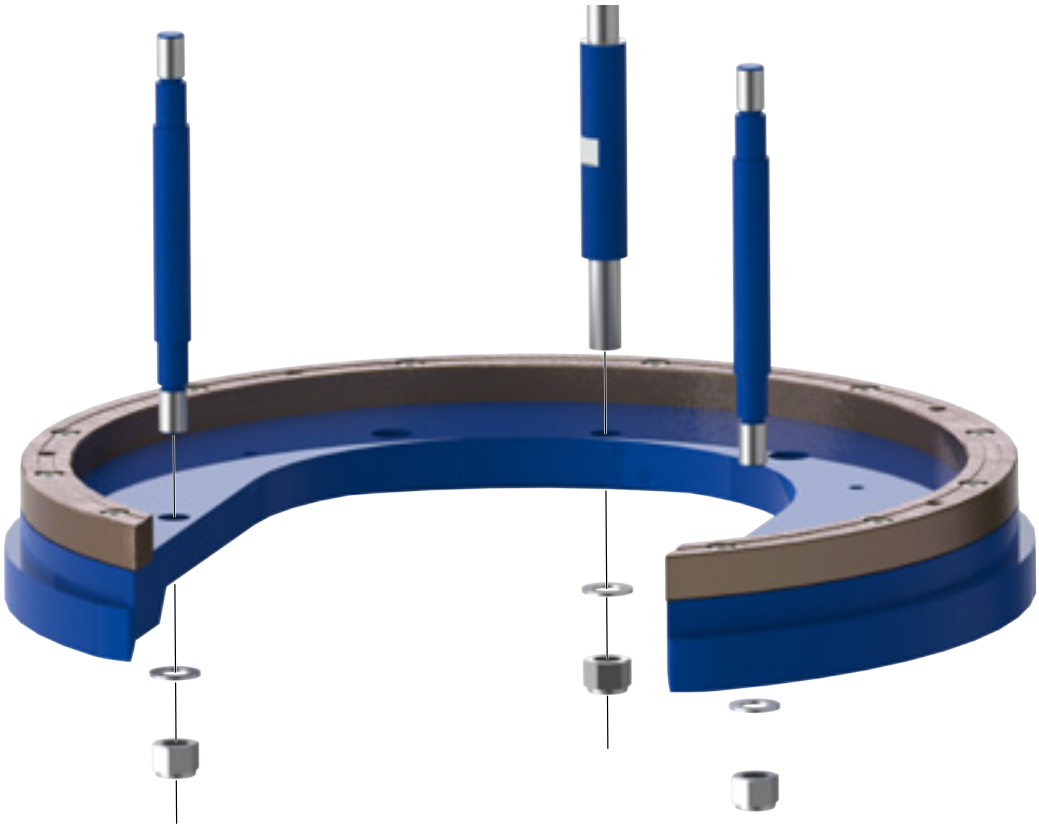

Illustration 3.H.5: Cageplate Spacer Installation

57. *Position the bottom cage plate assembly under the rotary gear with the guide ring in the groove in the rotary gear. Place the top cage plate on to the rotary gear and cage plate spacers. Secure the tops of the front cage plate spacers using a 3/4” narrow lock washer and a 3/4” UNC nylock nut. Secure the top of the rear cage plate bolt/spacer to the top cage plate using two 7/8” UNC jam nuts.*
58. *Install the top and bottom brake band weldments (PN 1393-29-05). Attach the pivot ends to the remaining long support roller shafts and secure in place with external snap rings (PN 1429-131-04).*
59. *Secure the adjustment end of the brake bands to the brake band lugs welded to the top plate using 1/2” NC x 8-1/2” hex bolts, tensioning spring (PN 1040-29-04), spacers (PN 1393-29-04B), and 1/2” NC hex nuts, and 1/2” NC jam nuts as shown in illustration 3.H.6.:*

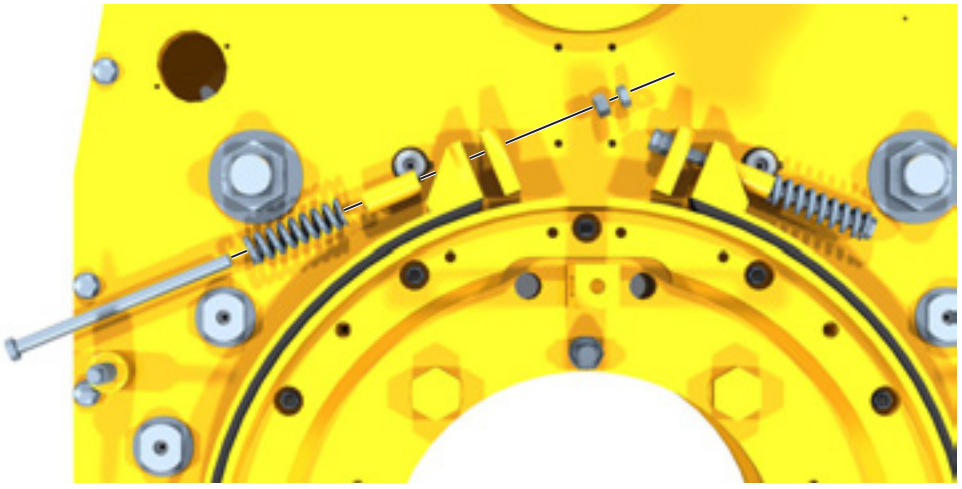

Illustration 3.H.6: Brakeband Adjustment Assembly Installation

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Assembly Procedures (Continued):

60. *Place the larger end of the backing pin retainer (PN 1393-40) over the rear cage plate bolt. Thread a 7/8” UNC nylock nut on to the top of the rear cage plate bolt.*
61. *Place the backing pin (PN 1393-39) in to one of the backing pin holes in the rear of the top cage plate. Attach the backing pin retainer to the backing pin using the backing pin knob (02-0017).*
62. *Install each door pivot support roller assembly, not including the pivot roller shafts, in their respective locations between the top and bottom plates, aligned with the drilled holes for the shafts.*
63. *Thread two 1/2” NC x 1” adjustment set screws into each door weldment from the front until the heads of the set screws are approximately flush with the vertical door plates. Thread a 1/2” UNC jam nut (to be used as lock-nuts on to each set screw from the inside of the door plate.*
64. *Install the door pivot shoulder bushings, PN 101-1795, in each door weldment (LH: 101-1754, RH: 101-1756).*

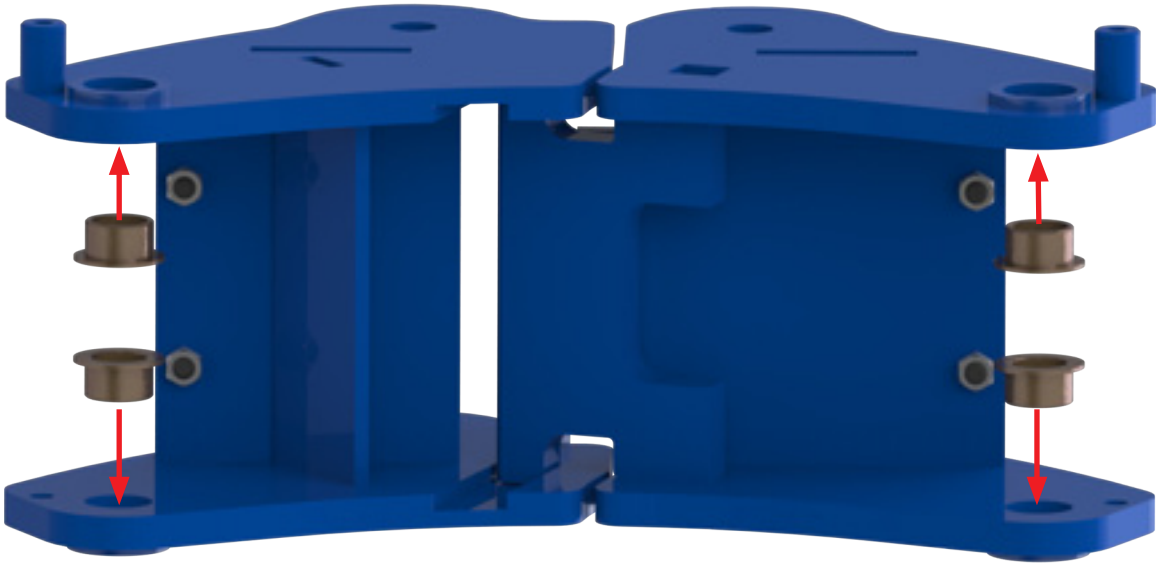

Illustration 3.H.8: Door Bushing Installation

65. *Attach the door assemblies to the tong:*
    - *i. Slide a 1” flat washer over each door pivot roller shaft (PN 101-3946).*
    - *ii. Align each door weldment with the pivot holes in the top and bottom plates.*
    - *iii. Lightly grease each door pivot roller shaft. Insert the door pivot shafts from the top through the door plates, tong plates, and the support roller components. The shaft may have to be lightly tapped with a soft metal or rubber hammer. Use caution when sliding the shaft through the support roller components.*
    - *iv. Secure each door pivot roller shaft with a second 1” flat washer, and a 1” thin nylock nut. Refer to Section 3.E.3 for information on aligning and adjusting doors.*
66. *Thread the door cylinder mounting posts (101-1796) to the top plate directly adjacent to the brake band pivot points.*

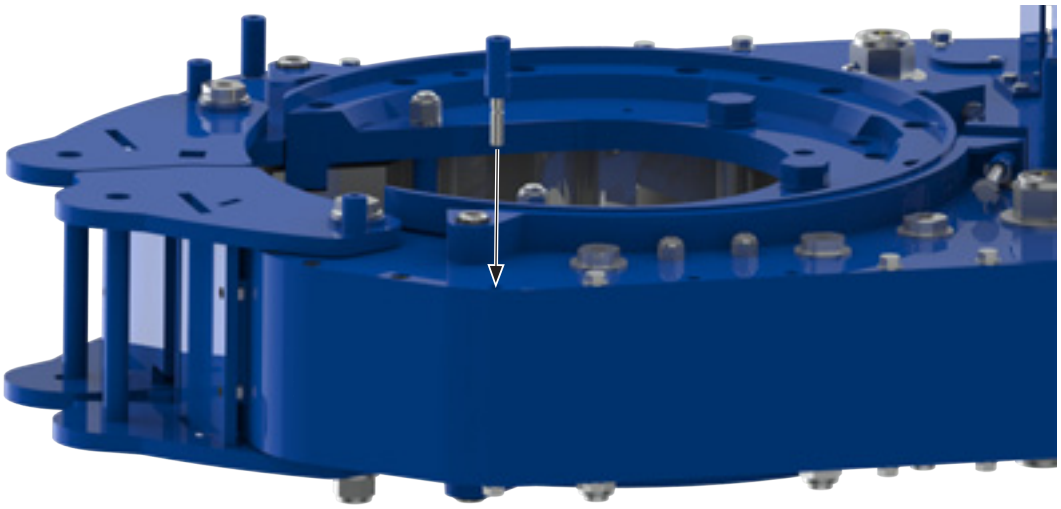

Illustration 3.H.9: Door Cylinder Mounting Post Installation

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Assembly Procedures (Continued):

67. *Attach the door cylinders (1037-A4-144) to the door cylinder mounting posts using 5/8” x 3/4” (UNC) hex socket shoulder bolts and 5/8” narrow flat washers.*
68. *Mount the front chain sling hanger weldments (PN 1393-A-2B) to the bottom plate adjacent to the bottom support segments using 1/2” UNC x 2-1/2” hex bolts and 1/2” lock washers. Secure the hanger weldments to the top plate using top hanger brackets (PN 101-0361) and 1/2” UNC x 2-1/2” hex bolts and 1/2” lock washers. Fasteners that have been inadvertently installed will need to be removed to accommodate the hanger brackets.*
69. *Mount the rear chain sling hanger weldment (101-0488) to the top plate directly behind the motor mount using four 1/2” UNC x 2-3/4” hex bolts and 1/2” lock washers, and two 3/4” UNC x 2” hex bolts, two 3/4” narrow flat washers, and two 3/4” UNC hex nylock nuts. Fasteners that have been inadvertently installed will need to be removed to accommodate the rear hanger bracket.*
70. *Mount the hydraulic support / dump valve protector weldment (PN 101-4850) to the top plate using two 3/8” UNC x 1” hex bolts and 3/8” lock washers. Mount the hydraulic support L-base weldment (PN 101-1943) to the top plate directly to the right of the motor mount weldment using two 1/2” UNC x 2-1/4” hex bolts and 1/2” lock washers (see illustration 3.H.10).*
71. *Fasten hydraulic support adjustment plate (PN 101-0022) to the forward-most support mount base using two 3/8” UNC x 1” hex bolts, two 3/8” narrow flat washers, and 3/8” UNC thin nylock nuts.*
72. *Fasten hydraulic support adjustment plate (PN 101-1538) to the middle support mount base (at the RH front corner of the motor mount) using two 3/8” UNC x 1” hex bolts, two 3/8” narrow flat washers, and 3/8” UNC thin nylock nuts.*

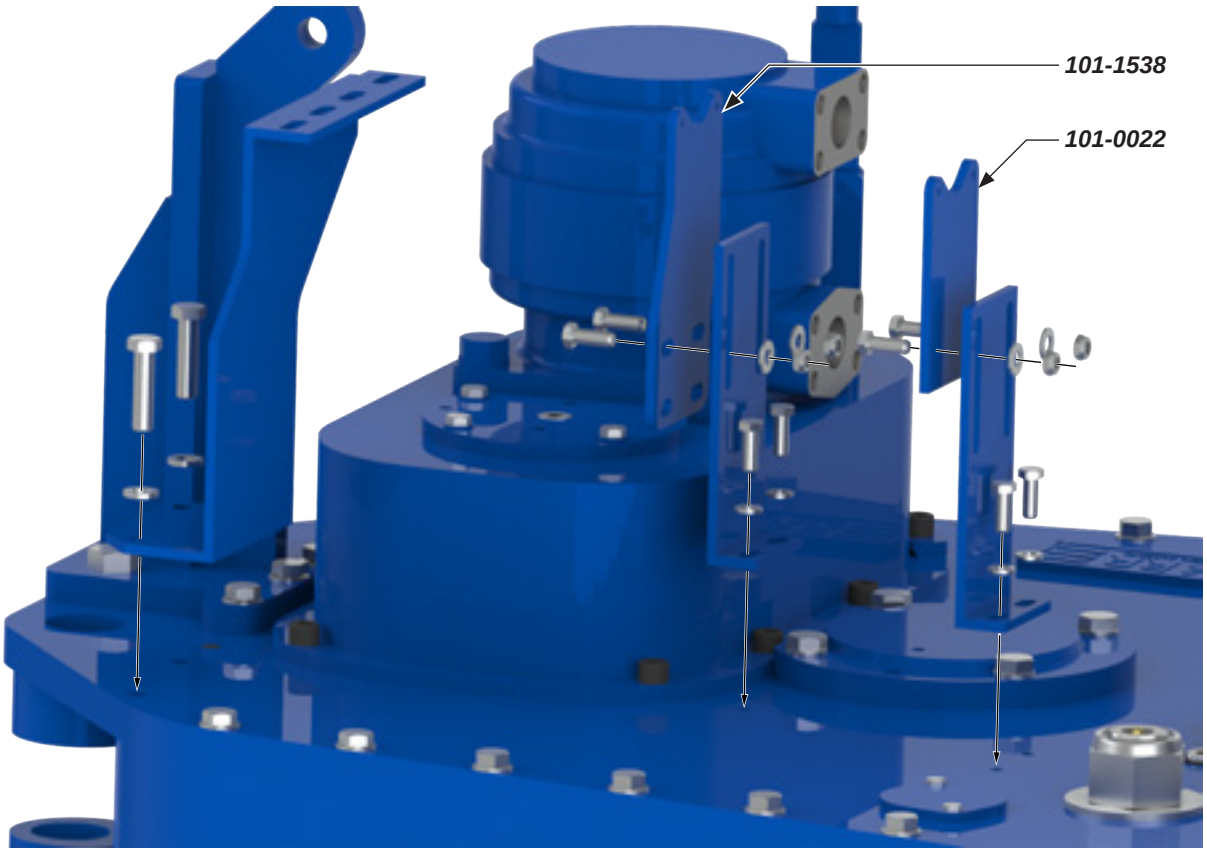

Illustration 3.H.10: Hydraulic Support Installations

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Assembly Procedures (Continued):

73. *Mount the hydraulic valve supports (PN 101-1442) to the top plate using one 3/8” UNC x 1-1/4” hex bolt and 3/8” lock washer per mount. Attach the valve bank mounting plate (101-5009) to the hydraulic valve supports using two 1/2” UNC x 1-1/4” hex bolts and 1/2” lock washers.*

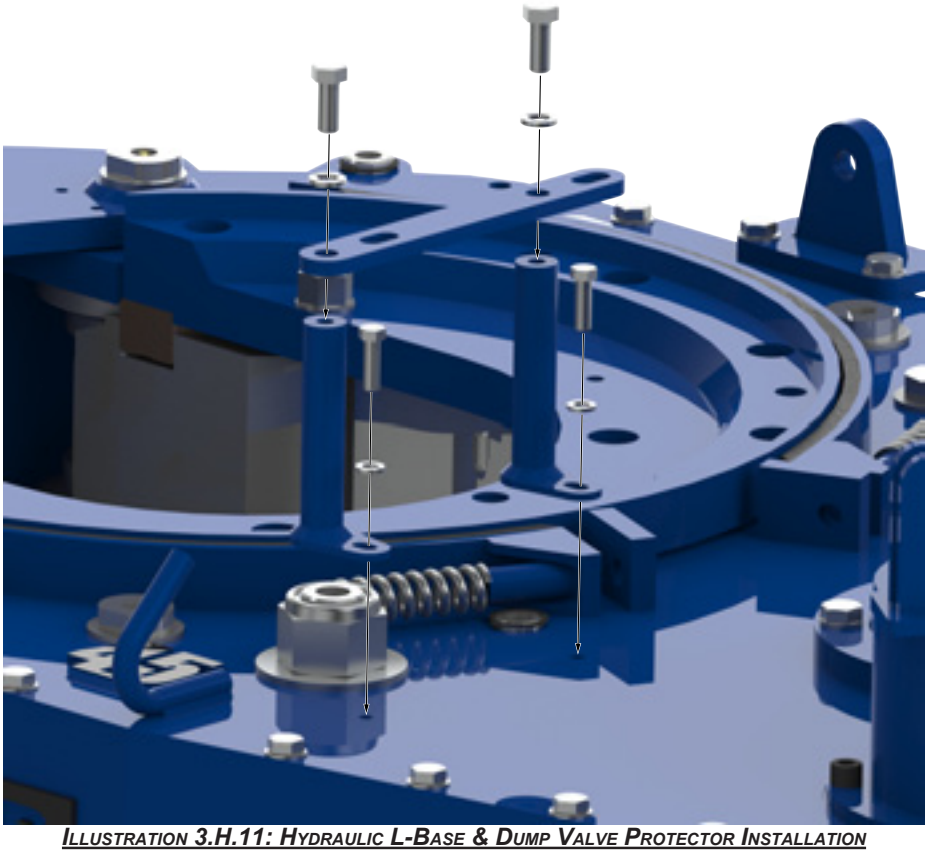

ILLUSTRATION 3.H.11: HYDRAULIC L-BASE & DUMP VALVE PROTECTOR INSTALLATION

74. *Install grease fittings in tong:*
    - *i) Install one 1/4” straight thread grease fitting (PN 02-0097) into the top of each support roller shaft, including the door pivot roller shafts (12 locations total).*
    - *ii) Install one 1/8” NPT grease fitting (PN 02-0005) into the end of each rotary idler assembly, located on the top face of the tong (2 total).*
    - *iii) Install one 1/8” NPT grease fitting (PN 02-0005) into the end of each pinion idler assembly, located on the bottom face of the tong (2 total).*
    - *iv) Install two 1/8” NPT 90° grease fittings (PN 02-0093) in each pinion bearing cap (4 total).*
    - *v) Install one 1/8” NPT grease fitting (PN 02-0005) into the end of the clutch shaft, in the centre of the clutch bearing cap.*
    - *vi) Install two 1/8” NPT 90° grease fittings (PN 02-0093) in clutch bearing cap (two locations total).*
    - *vii) Install one 1/8” NPT grease fitting (PN 02-0005) into the end of the lay gear shaft, in the centre of the lay gear bearing cap.*
    - *viii) Install two 1/8” NPT 90° grease fittings (PN 02-0093) in lay gear bearing cap (two locations total).*
    - *ix) Install two 1/8” NPT grease fitting (PN 02-0005) in the rear of the motor mount.*
    - *x) Install four 1/8” NPT grease fittings (PN 02-0005) in each cage plate (8 total).*
75. *Install safety door components (if equipped) to the door assembly:*
    - *i. Attach safety door latch block, PN AE13-302M to the top of the RH door weldment using two 3/8” UNC x 1” hex bolts and 1/2” lock washers.*
    - *ii. Attach safety door latch block, PN AE13-301S, to safety door latch plate, PN AE13-311, using three 3/8” UNF x 1” flat head countersunk cap screws.*
    - *iii. Insert load plunger, PN AE12-306, into LH safety door latch block.*

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Assembly Procedures (Continued):

75. *Install safety door components (continued):*

    iv. *Attach three 1/4” NPT JIC elbows to the Deltrol safety door valve, PN 08-0337M. Position a 15/16” valve lock nut as shown in illustration 3.H.12, and secure the safety door valve to the safety door latch block using the valve lock nut.*

    v. *Secure the safety door guard to the LH door weldment using three 3/8” NC x 1” hex bolts and 1/2” lock washers.*

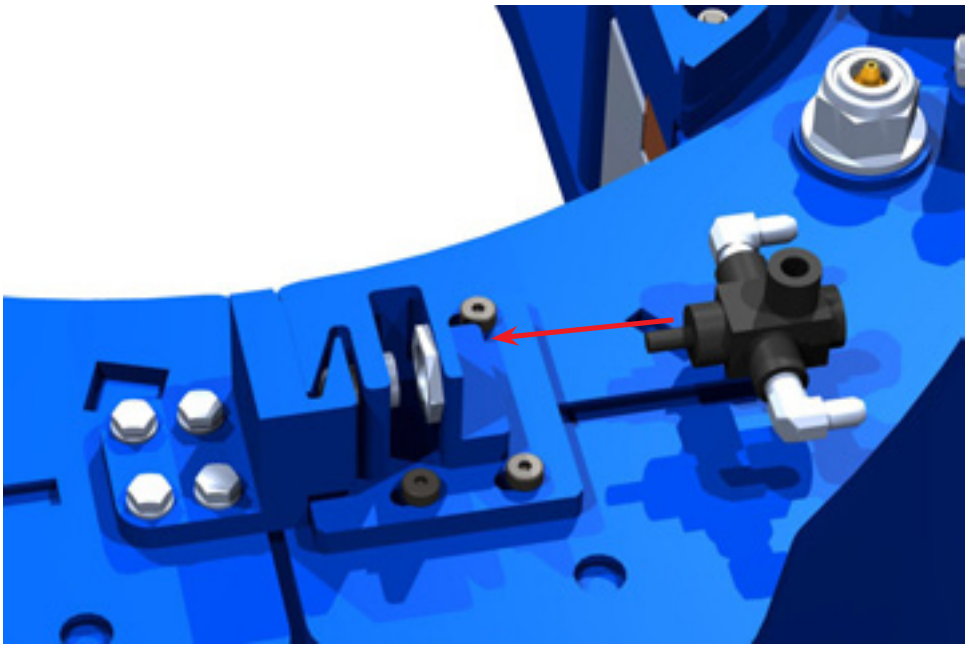

Illustration 3.H.12: Safety Door Component Installation

76. *Bolt four leg weldments (PN 997-D8-160A) to the bottom plate using one 7/8” UNC x 1-1/4” hex socket head cap screw and one regular 7/8” flat washer per leg weldment.* ***ASSEMBLY NOTE:*** *Some previous-generation KT-14000 tongs use only one rear leg centered on the bottom plate directly adjacent to the clutch bearing cap.*

77. *Bolt the assembled hydraulic valve bank to the valve supports installed in Step 73 using two 1/2” UNC x 5” hex bolts, four 1/2” narrow flatwashers, and two 1/2” UNC nylock nuts.*

78. *Secure the inlet and discharge lines to the hydraulic support structures installed in Steps 70 - 72.*

79. *Attach remainder of hydraulic components, and make hydraulic connections where necessary.* ***ASSEMBLY NOTE:*** *Ensure hydraulic connections are performed by an authorized hydraulic technician, in accordance with the supplied hydraulic schematic.*

80. *Use a crane to support the chain sling assembly (PN 101-1343). Attach the chain sling to the front chain sling hangers and the rear hanger using shackle assemblies (PN 02-9063).*

I. DAILY INSPECTION & MAINTENANCE CHECKLIST (POWER TONG)

Farr recommends that the following inspection and maintenance procedures be performed before each use, and at least once per day when the tong is in steady use, in the order in which they are listed.

1. ☐ *Rotate cage plate/rotary gear until the opening in the rotary gear faces towards the rear of the tong.*

DO NOT PERFORM ANY FURTHER ACTIONS OR MAINTENANCE WHILE THE TONG IS CONNECTED TO ANY HYDRAULIC POWER SUPPLY. FARR RECOMMENDS THAT ALL HYDRAULIC LINES ARE FULLY DISCONNECTED, AND RESIDUAL HYDRAULIC PRESSURE IS BLED OFF. ENSURE ADEQUATE CONTAINMENT IS IN PLACE TO PREVENT ENVIRONMENTAL CONTAMINATION FROM RESIDUAL HYDRAULIC FLUID.

DEPRESSURIZE HYDRAULIC SYSTEM IN PREPARATION FOR MAINTENANCE:

2. ☐
   1) *Rotate the tong to the “open throat” position. Ensure tong and backup doors (if equipped) are closed. Fully extend the lift cylinder*
   2) *De-energize the power unit.*
   3) *Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.*
   4) *Remove the hydraulic SUPPLY line from the equipment.*
   5) *Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.*
   7) *Disconnect the hydraulic RETURN line from the equipment.*
   8) *Disconnect remaining hoses such as case drains, or lines connected to the turns counter.*

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE INJURIES

3. ☐ *Perform an initial wash of the tong in order to remove the majority of dirt and grease build-up. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid and dirty grease.*
4. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*
5. ☐ *Use a flashlight to perform a visual inspection of the gear train through the access panel and the opening of the rotary gear. If gear damage or chips of metal are seen, the tong should be removed from service and overhauled to avoid further damage. Replace access panel when inspection is complete.*
6. ☐ *Perform a visual inspection of all fasteners and protruding body pieces (example: hydraulic valve mounts, inlet & outlet line supports, tong legs, shifter handle pivot lugs). Tighten or replace loose or missing fasteners. Farr recommends that damaged or missing body parts be repaired or replaced as soon as possible.*
7. ☐ *Inspect the jaws and dies. Inspect the jaw roller pins for signs of damage - replace pins if necessary. If the pins are welded in place, replace the entire jaw assembly. Ensure dies are secure in the jaw - replace worn dies if necessary. Ensure that the jaw rollers rotate freely. Check to ensure the size of the loaded jaws match the size of casing or pipe you are running.*
8. ☐ *Perform a visual inspection of all lifting points - if visible damage is seen, including cracks, broken lugs, distorted metal, etc. replace damaged part(s) before placing tong in service. Also inspect all chains, master links, and turnbuckles - again, if any damage is noted replace the damaged part(s) before placing the tong in service.*
9. ☐ *Inspect tong for signs of premature wear, or moving parts that are rubbing (bare metal where there used to be paint is a good indication of wear.*
10. ☐ *Inspect backing pin(s). If cracked, broken, or bent it (they) must be replaced.*
11. ☐ *Inspect top and bottom brake band linings - replace if necessary. Unequal wear of the brake bands indicates that the brake band tension is not evenly adjusted. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands.*
12. ☐ *Perform a visual inspection of all hydraulic lines. Replace flexible lines if they appear to be cracked, fatigued, or have visible signs of wear from contact with a rigid object.*

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13. ☐ *Perform a visual inspection of all hydraulic lines. Replace flexible lines if they appear to be cracked, fatigued, or have visible signs of wear from contact with a rigid object.*

14. ☐ *Perform a complete greasing of the tong - refer to Maintenance section of the technical manual*

15. ☐ *Ensure main supply and return connections to the tong are fully made up. Re-connect the remainder of the hydraulic lines, and, if applicable, the electrical line to the turns counter.*

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

If using a stand-alone power unit, start it now - refer to the power unit technical manual for startup procedures. Listen to power unit for a moment to see if there are any unusual mechanical sounds (rubbing, grinding, excessive pump noise). If using a diesel unit, allow sufficient time for the engine to reach operating temperature before increasing engine RPM. Once engine is warm, gradually increase engine RPM until operating speed is reached.

16. ☐ *Ensure that supply pressure is at or above the tong’s specified operating pressure, and that the return pressure is less than 350 psi.*

17. ☐ *Perform a visual inspection of pressurized hydraulic lines. Document and correct any hydraulic fluid leaks.*

18. ☐ *Perform a full functional test of the tong. Report and correct any hydraulic leaks from the hydraulic valve bank, or from any hydraulic cylinders that are used.*

19. ☐ *Perform a visual inspection of the load cell. If using a tension load cell, replace any cracked, broken, or distorted components including links and chains. If using a compression load cell, replace any component that has been crushed or otherwise distorted through compression.*

20. ☐ *If applicable, inspect the load cell anchor pins (tension load cell only). Replace the anchor pins if cracking or metal distortion is seen.*

21. ☐ *If applicable, the weld securing the single load cell anchor to the bridge bar main plate must be inspected (compression load cell only). If the integrity of the weld has been compromised, the tong must be removed from service until the weld is repaired. The load cell beam will need to be disconnected and removed so the weld is visible. Before re-installing the beam, liberally grease the anchor pin before reinserting into the load cell beam.*

22. ☐ *Test safety door feature (if equipped). Open the tong door(s), and attempt to rotate the cage plate at low speed (low gear) in both directions (makeup and breakout). If cage plate begins rotating, the safety door mechanism is not functional, and the tong must be removed from service until the safety door mechanism can be repaired. If the safety door is operating correctly, cage plate rotation will not be inhibited once the door is closed and latched.*

NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR

23. ☐ *While rotating the cage plate, ensure that the jaws properly cam. If the jaws do not cam properly, the brake bands need to be tightened. Incrementally adjust both the top and bottom brake bands EQUALLY until proper cam action is achieved (see section 3.E.1).*

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J. MONTHLY MAINTENANCE CHECKLIST - POWER TONG

The following maintenance checklist is intended as a guideline rather than a definitive maintenance schedule. Your equipment may require more, or less, maintenance depending upon the frequency of use, the percentage of maximum torque that your equipment is routinely subjected to, and the field conditions under which your equipment operates. Farr recommends that the following inspection and maintenance procedures be performed monthly, or in conjunction with your maintenance foreman’s experience and best estimate of when your equipment is due for this maintenance.

1. ☐ *Rotate cage plate/rotary gear until the opening in the rotary gear faces towards the rear of the tong.*

DO NOT PERFORM ANY FURTHER ACTIONS OR MAINTENANCE WHILE THE TONG IS CONNECTED TO ANY HYDRAULIC POWER SUPPLY. FARR RECOMMENDS THAT ALL HYDRAULIC LINES ARE FULLY DISCONNECTED, AND RESIDUAL HYDRAULIC PRESSURE IS BLED OFF. ENSURE ADEQUATE CONTAINMENT IS IN PLACE TO PREVENT ENVIRONMENTAL CONTAMINATION FROM RESIDUAL HYDRAULIC FLUID.

2. ☐

Depressurize Hydraulic System In Preparation For Maintenance:

1) *Rotate the tong to the “open throat” position. Ensure tong and backup doors (if equipped) are closed. Fully extend the lift cylinder*
2) *De-energize the power unit.*
3) *Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.*
4) *Remove the hydraulic SUPPLY line from the equipment.*
5) *Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.*
7) *Disconnect the hydraulic RETURN line from the equipment.*
8) *Disconnect remaining hoses such as case drains, or lines connected to the turns counter.*

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE INJURIES

3. ☐ *Clean the exterior of the tool thoroughly, using either water (if using a pressure washer ensure a low-pressure wash wand is used), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents.*

4. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*

5. ☐ *Clean the interior of the tong thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents. Make a note if any metal shavings or metal pieces are flushed out of the gear train cavity - if shavings or metal pieces are seen the tong must be overhauled before it is returned to service.*

6. ☐ *Inspect all fasteners and fastener safety wires (if equipped). Replace any missing fasteners - use Grade 8 bolts only unless otherwise specified. Re-torque all external fasteners to SAE specifications.*

7. ☐ *Repair or replace any damaged or missing external body parts, such as torque gauge mounts, hydraulic supports, safety door protectors, etc.*

8. ☐ *Perform a visual inspection of all fasteners and protruding body pieces (example: hydraulic valve mounts, inlet & outlet line supports, tong legs, shifter handle pivot lugs). Tighten or replace loose or missing fasteners. Farr recommends that damaged or missing body parts be repaired or replaced as soon as possible.*

9. ☐ *Inspect tong for signs of premature wear, or moving parts that are rubbing (bare metal where there used to be paint is a good indication of wear.*

10. ☐ *Inspect all paint - locations in which the paint has been damaged must be repaired prior to the tong being returned to service. Prepare areas to be painted to ensure they are free of grease, dirt, or solvent. Touch up using a solvent-based acrylic paint - “Farr Blue” is paint number RAL5005 (contact Farr sales for paint number for custom paint applications). Allow sufficient time for paint to dry before proceeding.*

11. ☐ *Inspect all external welds. Any weld that is cracked or separating must be repaired and repainted before returning the tong to service.*

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12. ☐ *Perform a visual inspection of all lifting points - if visible damage is seen, including cracks, broken lugs, distorted metal, etc. replace damaged part(s) before placing tong in service. Also inspect all chains, master links, and turnbuckles - again, if any damage is noted replace the damaged part(s) before placing the tong in service. Refer to Section 2A of the technical manual (Sling/Load Bearing Device Safety) for information on recommended testing and recertification. Please note that turnbuckles with part number 101-3086 (short turnbuckles) use a high-strength pin which must be supplied by Farr.*

“SHORT” TURNBUCKLES HAVING PART NUMBER 101-3086 EMPLOY HIGH-STRENGTH PINS WHICH MUST BE SUPPLIED BY FARR.

13. ☐ *Rotate the gear train by hand, and use a flashlight to perform a visual inspection of the gear train through the access panel and the opening of the rotary gear while the gear train is being rotated. If gear damage or chips of metal are seen, the tong should be removed from service and overhauled to avoid further damage. Replace access panel when inspection is complete.*

14. ☐ *Inspect all jaws and dies in use for the maintenance interval. Inspect the jaw roller pins for signs of damage - replace pins if necessary. If the pins are welded in place, remove and quarantine the jaw until the weld is repaired. Ensure dies are secure in the jaw - replace worn dies if necessary. Ensure that the jaw rollers rotate freely.*

15. ☐ *Inspect backing pin(s). If cracked, broken, or bent it (they) must be replaced.*

16. ☐ *Inspect top and bottom brake band linings - replace if necessary. Unequal wear of the brake bands indicates that the brake band tension is not evenly adjusted. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands.*

17. ☐ *Inspect door springs. Ensure the springs retain sufficient strength to be able to assist the opening of the door, and to keep the door open. The springs should also help to “snap” the door shut.*

18. ☐ *Inspect backup springs (if applicable). The rear extension springs should be equally extended, and the front leg springs should be equally compressed. Ensure that neither of the rear backup springs have been over-extended and lack sufficient tension to adequately support the backup. Ensure that neither of the front leg springs have been over-compressed, and still retain enough spring strength to support the front of the backup.*

19. ☐ *Extend all hydraulic cylinders, and inspect cylinder rods for signs of mechanical damage, flaking, or rust. Farr recommends that damaged cylinders be replaced prior to storage.*

20. ☐ *Perform a visual inspection of all hydraulic lines. Replace flexible lines if they appear to be cracked, fatigued, or have visible signs of wear from contact with a rigid object. If your tong is equipped with rigid hydraulic lines, replace any line that is dented or appears to be stressed or cracked.*

21. ☐ *Generously fill the gear train housing with grease through the access panel, and also through the opening in the rotary gear. Perform a full lubrication - refer to Maintenance section of manual to determine lubrication points.*

22. ☐ *Ensure main supply and return connections to the tong are fully made up. Re-connect the remainder of the hydraulic lines, and, if applicable, the electrical line to the turns counter.*

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

If using a stand-alone power unit, start it now - refer to the power unit technical manual for startup procedures. Listen to power unit for a moment to see if there are any unusual mechanical sounds (rubbing, grinding, excessive pump noise). If using a diesel unit, allow sufficient time for the engine to reach operating temperature before increasing engine RPM. Once engine is warm, gradually increase engine RPM until operating speed is reached.

23. ☐ *Ensure that supply pressure is at or above the tong’s specified operating pressure, and that the return pressure is less than 350 psi.*

24. ☐ *Perform a visual inspection of pressurized hydraulic lines. If any hydraulic fittings or hoses are leaking they must be repaired or replaced before proceeding.*

25. ☐ *Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train. De-energize the power unit, and perform another generous lubrication of the gear train, including the gear housing.*

26. ☐ *Energize power unit. Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train.*

27. ☐ *De-energize the power unit, and perform a third generous lubrication of the gear train, including the gear housing.*

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28. ☐ *Re-energize power unit and extend all hydraulic cylinders. Inspect cylinder rods for signs of mechanical damage, flaking, or rust. Farr recommends that damaged cylinders be replaced.*

29. ☐ *Rotate tong in low gear for 5 minutes while monitoring pressurized seals and hydraulic lines. If a seal, line, or fitting begins to leak while tong is rotating, it must be replaced before the equipment is returned to service.*

30. ☐ *Rotate tong in high gear for 5 minutes while monitoring temperature of top and bottom bearing caps. If the bearing caps are hot to the touch (higher than approximately 50°C) replace the applicable bearings. Likewise if the tong is making unusual noises check for damaged bearings (see Maintenance Manual for all bearing locations).*

31. ☐ *Install load cell. If using a tension load cell, perform a visual inspection and replace any cracked, broken, or distorted components including links and chains. If using a compression load cell, replace any component that has been crushed or otherwise distorted through compression.*

32. ☐ *If applicable, inspect the load cell anchor pins (tension load cell only). Replace the anchor pins if cracking or metal distortion is seen.*

33. ☐ *If applicable, the weld securing the single load cell anchor to the bridge bar main plate must be inspected (compression load cell only). If the integrity of the weld has been compromised, the tong must be removed from service until the weld is repaired. The load cell beam will need to be disconnected and removed so the weld is visible. Before re-installing the beam, liberally grease the anchor pin before reinserting into the load cell beam.*

34. ☐ *Inspect load cell for damage or signs of stress. Check oil level in load cell and fill if necessary (refer to technical manual Section 7 or Section 8).*

35. ☐ *While rotating the cage plate, ensure that the jaws properly cam. If the jaws do not cam properly, the brake bands need to be tightened. Incrementally adjust both the top and bottom brake bands EQUALLY until proper cam action is achieved. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands.*

36. ☐ *Perform a full functional test of the tong including, if applicable, backup components, lift cylinder, and float frame components. Report and correct any hydraulic leaks from the hydraulic valve bank, or from any hydraulic cylinders that are used.*

37. ☐ *Test safety door feature (if equipped). Begin rotating the tong at low speed, and open the tong door(s). If rotation does not immediately stop, this is an indication that the safety door mechanism is not operating correctly and the tong must be removed from service until the mechanism is repaired. Repeat the test while operating the tong in the opposite direction. If the safety door is operating correctly, cage plate rotation will not be inhibited once the door is closed and latched.*

NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR

38. ☐ *Farr recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external unpainted surfaces (and chain slings) EXCEPT cylinder rods, jaw rollers, and rotary gear camming surfaces. Refer to manufacturer data sheets for proper application and safety information.*

Once all of the above maintenance checklist items have been satisfactorily completed the tool may be returned to service.

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K. DAILY INSPECTION & MAINTENANCE CHECKLIST (POWER UNIT)

Farr recommends that the following inspections and maintenance procedures be performed before each use, and at least once per day when the equipment is in steady use, in the sequence in which they are listed. Rigorous inspection and maintenance, especially lubrication, is essential in order to ensure that your equipment always meets specifications, and to prevent catastrophic failures that can severely damage your equipment and cause worker injury.

If using a stand-alone power unit, perform the following inspection and maintenance procedures before each use, and at least once per day when the power unit is in steady use:

Do not perform any maintenance while the power unit is energized (electric) or if the engine is running (diesel). Ensure the electrical supply is locked out, or, if using a diesel power supply, ensure that the engine is locked out or the starting mechanism otherwise disabled.

DIESEL ONLY

1. ☐ *Check engine oil levels - add if necessary*
2. ☐ *Check diesel fuel tank - fill if necessary.*
3. ☐ *Visually inspect all fan belts.*
4. ☐ *Activate mechanical shut-off device - ensure that shut-off switch on engine is engaging when manual shut-off switch is actuated.*

ELECTRIC ONLY

1. ☐ *Visually inspect all electrical lines and visible connections. If your unit is NOT explosion proof, open the electrical enclosure and VISUALLY inspect contacts and connections for signs of corrosion or arcing. Do not open explosion-proof enclosures.*

NEVER PLACE HANDS INSIDE AN ELECTRICAL ENCLOSURE UNLESS YOU HAVE CONFIRMED THAT THE POWER HAS BEEN DISCONNECTED AND LOCKED OUT

2. ☐ *Visually inspect main electrical line between main power source and power unit.*

ALL UNITS

5. ☐ *Perform a visual inspection of all parts. Check to ensure there are no loose or missing fasteners.*
6. ☐ *Check hydraulic fluid level - ensure cold level is approximately half-way up the sight glass on the hydraulic fluid reservoir.*
7. ☐ *Perform a visual inspection to ensure there are no hydraulic fluid leaks - correct if necessary.*
8. ☐ *Check that the main supply and return lines on the hydraulic fluid reservoir are both fully open.*
9. ☐ *Apply grease to any grease fittings that your power unit may have. Apply grease to each fitting until grease is visibly displaced from bearing, or as recommended by your power unit manual.*
10. ☐ *Ensure supply and return connections at the power unit and at the equipment in use are fully made up.*

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

11. ☐ *Check hydraulic fluid filter back pressure (must be done while fluid is circulating). If needle on indicator gauge is in the red zone, the filter should be changed the next time the unit is shut down*

L. TUBULAR CONNECTION EQUIPMENT DE-COMMISSIONING PROCEDURE

Perform the following decommissioning procedures when removing tubular connection equipment from service, with the intent of short to long-term storage. These procedures are essential for ensuring proper protection of the equipment from environmental attack, and to aid in the quick turnaround when returning the equipment to service.

Store all o-rings, seals, packings, gaskets, etc. in strong moisture proof, airtight containers. Ensure that these items are not crushed, nicked, or otherwise damaged.

Do not perform any further actions or maintenance while the tong is connected to any hydraulic power supply. Farr recommends that all hydraulic lines are fully disconnected, and residual hydraulic pressure is bled off. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid.

Depressurization Procedure In Preparation For Storage:

1) *Rotate the tong so that the opening in the rotary gear faces the gear train (towards the rear of the tong). Ensure tong and backup doors (if equipped) are closed. Fully extend the lift cylinder (if equipped). If mounted in a frame, retract the float cylinders (if equipped).*
2) *De-energize the power unit.*
3) *Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.*
4) *Remove the hydraulic SUPPLY line from the equipment.*
5) *Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.*
7) *Disconnect the hydraulic RETURN line from the equipment.*
8) *Disconnect remaining hoses such as case drains, or lines connected to the turns counter.*

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE INJURIES

1. ☐ *Perform an initial wash of the tool in order to remove the majority of dirt and grease build-up. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid and dirty grease.*
2. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*
3. ☐ *Clean the interior of the tong thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents. Make a note if any metal shavings or metal pieces are flushed out of the gear train cavity - if shavings or metal pieces are seen the tong must be overhauled before it is returned to service.*
4. ☐ *Clean the exterior of the tool thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents.*
5. ☐ *Inspect all fasteners and fastener safety wires. Replace any missing fasteners - use Grade 8 bolts only. Re-torque all external fasteners to SAE specifications.*
6. ☐ *Inspect backing pin(s). If cracked, broken, or bent it (they) must be replaced.*
7. ☐ *Repair or replace any damaged or missing external body parts, such as torque gauge mounts, hydraulic supports, safety door protectors, etc.*
8. ☐ *Inspect all paint - locations in which the paint has been damaged must be repaired prior to storage. Prepare areas to be painted to ensure they are free of grease, dirt, or solvent. Touch up using a solvent-based acrylic paint - “Farr Blue” is paint number RAL.5005. Allow sufficient time for paint to dry before proceeding.*
9. ☐ *Perform a liberal lubrication of the equipment - refer to Maintenance section of manual to determine lubrication points. Generously fill the gear train housing with grease through the access panel, and also through the opening in the rotary gear.*
10. ☐ *Connect the equipment to a hydraulic power unit. Ensure all lines are fully made up to prevent equipment damage from excessive back pressure. Do not neglect to connect the motor drain.*
11. ☐ *Energize power unit.*
12. ☐ *Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train. De-energize the power unit, and perform another generous lubrication of the gear train, including the gear housing.*

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13. ☐ *Energize power unit. Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train.*

14. ☐ *De-energize the power unit, and perform a third generous lubrication of the gear train, including the gear housing.*

15. ☐ *Energize power unit, and rotate the tong for a final time, one minute in one direction, stop, and reverse the direction of rotation for another minute, this time ending with the rotary gear in the “open throat” position.*

16. ☐ *Extend all hydraulic cylinders, and inspect cylinder rods for signs of mechanical damage, flaking, or rust. Farr recommends that damaged cylinders be replaced prior to storage.*

17. ☐ *If you are using a frame-mounted tool, the tong must be lowered onto the backup in order to remove the risk of sudden and catastrophic movement when pressure is removed from the float cylinders. Cover the top of the backup with protective cloth to protect the paint on the backup. Place two wooden beams across the top of the tong, ensuring that the beams have a minimum size of 4” x 4” x the width of the tong. Cover the tops of the wooden beams with more protective cloth to prevent paint damage to the tong. When lowering the tong onto the beams, ensure that the beams come into flat contact with the bottom of the tong, away from bearing caps, brake bands, or other protrusions on the bottom of the tong. Ensure that the tong hanger chains are loose, but not dangling into contact with the hangers or top plate of the tong.*

Depressurization Procedure For Storage:

1) *Rotate the tong to the “open throat” position.*
2) *Exercise each hydraulic cylinder several times - open the tong and backup doors (if equipped), retract and extend the remote backing pin ramp (if equipped), retract and extend the float cylinders. Leave all cylinders except for the door cylinders in their fully retracted position. The general idea is to have as little of the chrome cylinder rods exposed as possible.*
3) *De-energize the power unit.*
4) *Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.*
5) *Remove the hydraulic SUPPLY line from the equipment.*
6) *Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.*
7) *Connect a low-pressure air supply line (10 PSI or less) to the hydraulic supply line, and force a small amount of the remaining hydraulic fluid from the valve assembly - this will allow for thermal expansion of the hydraulic fluid if the equipment is stored or transported in high ambient temperatures. Failure to do this may result in damaged or destroyed seals in the equipment.*
8) *Disconnect the hydraulic RETURN line from the equipment.*
9) *Disconnect remaining hoses such as case drains, or lines connected to the turns counter.*

18. ☐ *If any hydraulic fittings or hoses are leaking they must be repaired or replaced before proceeding.*

19. ☐ *Wipe all excess grease from outside of equipment. Replace the access door panel. Use a solvent-based cleaner on rags to wipe all external surfaces to remove residual grease or hydraulic fluid. Once the outside surfaces have been de-greased, wipe all external surfaces with clean water to remove residual solvent.*

20. ☐ *Farr recommends that chain slings be removed and stored separately. Rigid slings and other rigid suspension devices may remain in place.*

21. ☐ *Apply grease or heavy oil to all exposed cylinder rods.*

22. ☐ *Farr recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external surfaces EXCEPT cylinder rods (including chain slings). Refer to manufacturer data sheets for proper application and safety information.*

DO NOT ALLOW ANTI-CORROSIVE AGENTS TO CONTACT CYLINDER RODS. CYLINDER ROD DAMAGE WILL OCCUR.

23. ☐ *Allow the anti-corrosive coating ample time to dry - refer to manufacturer data sheets for drying times at room temperature.*

24. ☐ *Wrap entire assembly in 100 gauge (1 mil) corrosion-inhibiting wrap, at least 3 layers thick. Attempt to ensure that the tool is well-sealed within the wrapping, including the bottom.*

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If possible, store in a sealed, climate controlled environment. If isolated storage is not available, Farr recommends storing your wrapped equipment in a secure, out-of-the-way location, using silica gel desiccant to reduce the humidity within the wrapping. As a guideline, use 125 g. of desiccant for each cubic metre of space, or 3.5 g. per cubic foot.

Calculation Of Required Desiccant

1) Calculate the trapped air volume by measuring the outside dimensions of the tool to be stored, and treat that as the volume to be stored. For example, the external dimensions of a KT20000 20” power tong are 80.25” x 50.5” x 28”, which calculates to an approximate volume of 113500 in^3, or 66 ft^3 (1.87 m^3).

2) Multiply the calculated air volume, in cubic feet, by the recommended amount of desiccant per cubic foot. Carrying forth the example used in the previous step, the required desiccant charge would be 3.5 g. x 66 ft^3, equaling 231 g. Several manufacturers offer silica gel desiccant in packaged quantities of 125 grams per bag, so two packages of desiccant would be required. Please keep in mind that this is a guideline only - more or less desiccant may be required in extreme environmental conditions.

For best corrosion resistance the equipment should be removed from storage and exercised on a regular basis, depending on the storage environment. Farr recommends that for equipment stored in a salt-water maritime or exposed dusty environment, repeat steps 9 through 24 monthly. For equipment stored in isolated storage in a non-maritime environment, repeat steps 9 through 24 quarterly. Replace desiccant packs at this time - depleted desiccant packs may be treated as regular dunnage.

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M. TUBULAR CONNECTION EQUIPMENT RE-COMMISSIONING PROCEDURE

Perform the following recommissioning procedures when removing tubular connection equipment from short or long-term storage back into regular service. These procedures are essential for ensuring proper equipment preparation and operation. The following procedures also assume that the decommissioning and storage procedures recommended by Farr have been strictly observed.

1. ☐ *Remove all protective plastic wrapping. If there are desiccant packs with the assembly, they may be disposed of with the regular garbage.*
2. ☐ *Remove the access panel on the side of the tong directly adjacent to the shifter mechanism.*
3. ☐ *Wipe excess grease or heavy oil from exposed cylinder rods.*
4. ☐ *If applicable, re-connect chain sling to lifting lugs. Perform a visual inspection of all lifting points - if visible damage is seen, including cracks, broken lugs, distorted metal, etc. replace damaged part(s) before placing tong in service. Also inspect all chains, master links, and turnbuckles - again, if any damage is noted replace the damaged part(s) before placing the tong in service. If your company requires yearly certification of lifting equipment, ensure that the most recent test date falls within the past year. Perform recertification if necessary.*
5. ☐ *Perform a liberal lubrication of the equipment - refer to Maintenance section of manual to determine lubrication points. Generously fill the gear train housing with grease through the access panel, and also through the opening in the rotary gear.*
6. ☐ *Connect the equipment to a hydraulic power unit. Ensure all lines are fully made up to prevent equipment damage from excessive back pressure. Do not neglect to connect the motor drain.*

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

7. ☐ *Energize power unit.*
8. ☐ *Ensure that supply pressure is at or above the tong’s specified operating pressure, and that the return pressure is less than 350 psi.*
9. ☐ *Perform a thorough inspection of pressurized hydraulic lines and fittings. Any leaking hydraulic fluid lines or fittings must be replaced before the equipment is returned to service.*
10. ☐ *Perform a thorough inspection of all seals. Any seal that is leaking or “weeping” must be replaced before the equipment is returned to service.*
11. ☐ *Rotate tong in low gear for 5 minutes while monitoring pressurized seals and hydraulic lines. If a seal, line, or fitting begins to leak while tong is rotating, it must be replaced before the equipment is returned to service. Finish this step with the rotary gear opening facing the gear train. De-energize the power unit.*
12. ☐ *Inspect all flexible hydraulic lines for signs of wear, blistering, or any other signs of potential failure - replace if signs of potential failure are identified.*
13. ☐ *Inspect the gear train housing. If the amount of grease is inadequate, liberally grease the gear train through the access panel, and through the opening in the rotary gear.*
14. ☐ *Inspect top and bottom brake band linings - replace if necessary. Unequal wear of the brake bands indicates that the brake band tension is not evenly adjusted. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands. Ensure that all grease is wiped from brake band linings and the parts of the cage plates that come into contact with the brake band linings*
15. ☐ *Re-install access panel. Install a set of pre-inspected jaws that are the correct size for the pipe or casing being run.*
16. ☐ *Install load cell. If using a tension load cell, perform a visual inspection and replace any cracked, broken, or distorted components including links and chains. If using a compression load cell, replace any component that has been crushed or otherwise distorted through compression.*
17. ☐ *If applicable, inspect the load cell anchor pins (tension load cell only). Replace the anchor pins if cracking or metal distortion is seen.*
18. ☐ *If applicable, the weld securing the single load cell anchor to the bridge bar main plate must be inspected (compression load cell only). If the integrity of the weld has been compromised, the tong must be removed from service until the weld is repaired. The load cell beam will need to be disconnected and removed so the weld is visible. Before re-installing the beam, liberally grease the anchor pin before reinserting into the load cell beam.*
19. ☐ *Re-energize power unit.*

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20. ☐ *Perform a full functional test of the equipment including, if applicable, backup components and float frame components. Report and correct any hydraulic leaks from the hydraulic valve bank, or from any hydraulic cylinders that are used.*

21. ☐ *If using a frame-mounted tong and backup system, raise the tong off the beams that it is resting upon. Remove the beams and protective cloths - inspect the paint on top of the backup and the bottom of the tong to ensure it has not been damaged by the beam.*

22. ☐ *Test safety door feature (if equipped). Open the tong door(s), and attempt to rotate the cage plate at low speed (low gear) in both directions (makeup and breakout). If cage plate begins rotating, the safety door mechanism is not functional, and the tong must be removed from service until the safety door mechanism can be repaired. If the safety door is operating correctly, cage plate rotation will not be inhibited once the door is closed and latched.*

NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR

23. ☐ *While rotating the cage plate, ensure that the jaws properly cam. If the jaws do not cam properly, the brake bands need to be tightened. Incrementally adjust both the top and bottom brake bands EQUALLY until proper cam action is achieved.*

24. ☐ *When all of the previous steps are completed, you may return your re-commissioned equipment to service.*

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Adequate maintenance and proper fluid selection is essential for minimizing hydraulic-related failures. All troubleshooting must be performed by a technician trained in hydraulic systems, and familiar with the equipment design, assembly and operation.

The following troubleshooting instructions are intended to be guidelines only. Any faults not solved through the use of this guide should be referred to our engineering department for their evaluation and recommendations.

A. TONG WILL NOT DEVELOP SUFFICIENT TORQUE

1. *Malfunctioning relief valve on tong hydraulic circuit.*
   a. *POSSIBLE PROBLEM: Relief pressure set too low.*

      SOLUTION: Increase setting. To check, block the oil line beyond the relief valve and determine pressure with a gauge.

   b. *POSSIBLE PROBLEM: Relief valve is stuck.*

      SOLUTION: Check for contamination of oil that may inhibit the way the valve actuates. Remove valve and clean, ensuring that the valve spring operates smoothly.

   c. *POSSIBLE PROBLEM: Relief valve is leaking.*

      SOLUTION: Check valve seat for scouring. Check oil seals. Check for particles stuck under the valve system.

2. *POSSIBLE PROBLEM: Directional valve is leaking.*

   SOLUTION: Check directional valve. Neutral position should return fluid directly to the reservoir. Replace or repair valve to ensure correct operation.

3. *POSSIBLE PROBLEM: Power unit is not producing adequate pressure.*

   SOLUTION: Troubleshoot power unit (see user’s manual for your particular unit).

4. *POSSIBLE PROBLEM: Poor hydraulic pressure at the tong despite adequate pressure at the power unit, or excessive back pressure in the return line.*

   SOLUTION: Restrictions exist in line between power unit and tong. Inspect integrity of self-sealing couplings to ensure they are allowing full fluid flow. Check to ensure no other restrictions exist (contaminated catch screens or filters, for example).

5. *POSSIBLE PROBLEM: Fluid viscosity is not appropriate (too high or too low).*

   SOLUTION: Ensure hydraulic fluid being used is the viscosity recommended by McCoy Drilling & Completions. Power unit pump may not prime if fluid is too heavy, and the hydraulic system will overheat if fluid is too light. Replace with proper viscosity fluid.

   SOLUTION: Hydraulic fluid viscosity is affected by environmental conditions. Ensure the fluid being used is suitable for high or low temperatures. Replace with proper viscosity fluid for the operating conditions if necessary.

6. *POSSIBLE PROBLEM: Worn or damaged tong motor causing slippage.*

   SOLUTION: Replace or repair worn or damaged motor.

7. *POSSIBLE PROBLEM: Damaged bearings or gears causing excessive drag.*

   SOLUTION: Replace or repair worn or damaged gears or bearings.

8. *POSSIBLE PROBLEM: Jaws slipping on pipe.*

   SOLUTION: Ensure jaw dies are not worn to the point that they cannot grip. Ensure the correct sized jaws are in use.

9. *POSSIBLE PROBLEM: Torque gauge is indicating incorrectly*

   SOLUTION: Incorrect gauge is being used. Ensure gauge is the proper range, and has been properly calibrated for the arm length of the equipment in use.

   SOLUTION: Gauge has been damaged. Check gauge operation and calibration on independent system.

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TONG WILL NOT DEVELOP SUFFICIENT TORQUE Cont’d:

10. *POSSIBLE PROBLEM: Load cell is measuring incorrectly.*

    SOLUTION: Incorrect load cell is being used.

    SOLUTION: Air is trapped in torque measuring circuit (load cell, hydraulic line, or gauge. Refer to torque measurement troubleshooting in Section 6 of this manual.

    SOLUTION: Load cell has been damaged. Replace load cell, or return to McCoy for repair and re-calibration.

11. *POSSIBLE PROBLEM: Incorrect motor speed selected.*

    SOLUTION: Maximum torque can only be developed when motor is in the lowest speed. Ensure motor is in low speed.

12. *POSSIBLE PROBLEM: Incorrect tong gear selected.*

    SOLUTION: Maximum torque can only be developed when tong is in low gear. Ensure tong is in low gear.

MCCOY COMPLETIONS & DRILLING GUARANTEES CALIBRATION OF A LOAD CELL/ TORQUE GAUGE ASSEMBLY FOR A PERIOD OF ONE YEAR. MCCOY SUGGESTS THAT THE LOAD CELL/TORQUE GAUGE ASSEMBLY BE RETURNED TO THE FACTORY FOR RE-CALIBRATION ON A YEARLY BASIS.

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B. FAILURE OF JAWS TO GRIP PIPE

1. *POSSIBLE PROBLEM: Dies have become too dull to provide adequate grip.*
   SOLUTION: Replace dies.

2. *POSSIBLE PROBLEM: Incorrect jaws are being used.*
   SOLUTION: Double-check jaw size to ensure they are rated for the diameter of pipe or casing being run.

3. *POSSIBLE PROBLEM: Incorrect dies are being used*
   SOLUTION: Ensure dies loaded in the jaws are appropriate for the type of pipe or casing being run.

4. *POSSIBLE PROBLEM: Brake band(s) is (are) insufficiently adjusted, not allowing jaws to cam properly.*
   SOLUTION: Adjust brake bands to give proper resistance to cage plates.

5. *POSSIBLE PROBLEM: Jaw roller broken or worn.*
   SOLUTION: Remove jaw assembly and inspect. Replace rollers that are visibly “flat-spotted” or otherwise damaged.

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C. TONG RUNNING TOO SLOWLY

1. *POSSIBLE PROBLEM: Obstruction in tong hydraulic circuit preventing adequate flow.*
   SOLUTION: Inspect self-sealing couplings to ensure they are properly engaged.
   SOLUTION: The main hydraulic lines (supply and discharge) to the tong are obstructed. Remove and clean if required.

2. *POSSIBLE PROBLEM: Power unit is not producing adequate flow or pressure.*
   SOLUTION: Troubleshoot power unit (see user’s manual for your particular unit).

3. *POSSIBLE PROBLEM: Tong motor is excessively worn and is leaking hydraulic fluid past the vanes.*
   SOLUTION: Replace motor, or rebuild as per Section 7 of this manual.

4. *POSSIBLE PROBLEM: Bearings in gear train and rotary section are excessively worn.*
   SOLUTION: Overhaul tong. See Section 3 of this manual for tong overhaul procedures.

5. *POSSIBLE PROBLEM: Shifter has malfunctioned and the tong is not shifting to high gear.*
   SOLUTION: Inspect and repair shift mechanism as necessary.

6. *POSSIBLE PROBLEM: Two-speed hydraulic motor (if equipped) is not set to correct speed.*
   SOLUTION: Check motor, and set to the correct speed if required.

7. *POSSIBLE PROBLEM: Safety door system is not properly adjusted - hydraulic fluid leak past Deltrol valve.*
   SOLUTION: Check and adjust safety door system.

8. *POSSIBLE PROBLEM: Hydraulic fluid viscosity too high.*
   SOLUTION: Ensure hydraulic fluid meets McCoy Drilling & Completions specifications.
   SOLUTION: Ensure hydraulic fluid is appropriate for climatic conditions, especially during cold-weather operation..

9. *POSSIBLE PROBLEM: By-pass valve not functioning.*
   SOLUTION: Check and repair.

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D. FAILURE OR DIFFICULTY OF TONG TO SHIFT

1. *POSSIBLE PROBLEM: Bent or broken shifter handle.*
   SOLUTION: Replace shifter handle.

2. *POSSIBLE PROBLEM: Bent or broken shifter yoke.*
   SOLUTION: Inspect and replace shifter yoke.

3. *POSSIBLE PROBLEM: “Frozen” or hard-to-move shifter handle.*
   SOLUTION: Grease shifter shaft.

4. *POSSIBLE PROBLEM: Bent or broken shifter shaft.*
   SOLUTION: Replace.

5. *POSSIBLE PROBLEM: Locking nuts on shifting shaft have loosened and position of yoke has changed.*
   SOLUTION: Reposition yoke and re-tighten locking nuts.

6. *POSSIBLE PROBLEM: Shifting yoke has come loose from shifting shaft*
   SOLUTION: Inspect yoke and inspect for damage. If free of damage, replace on shaft and tighten locking nuts.

7. *POSSIBLE PROBLEM: Tong pops out of gear*
   SOLUTION: Ensure that detent ball & spring assembly has been correctly set.

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H. GENERAL COMMENTS

The following factors generally contribute to poor hydraulic operation and premature wear of equipment:

1. *Contaminated hydraulic fluid due to overuse, overheating, or inadequate fluid filtration.*
2. *Unsuitable hydraulic fluid, especially in extreme climatic conditions.*
3. *Defective packing or seals in components of the hydraulic system.*
4. *Poor or incomplete hydraulic system training. Users must be fully qualified to operate the equipment, and have complete understanding of the hydraulic system.*

If your hydraulic troubleshooting procedures involve flow and pressure tests at the power unit, McCoy Completions & Drilling recommends construction of a test rig that can easily be connected to the main suction and discharge ports of the power unit.

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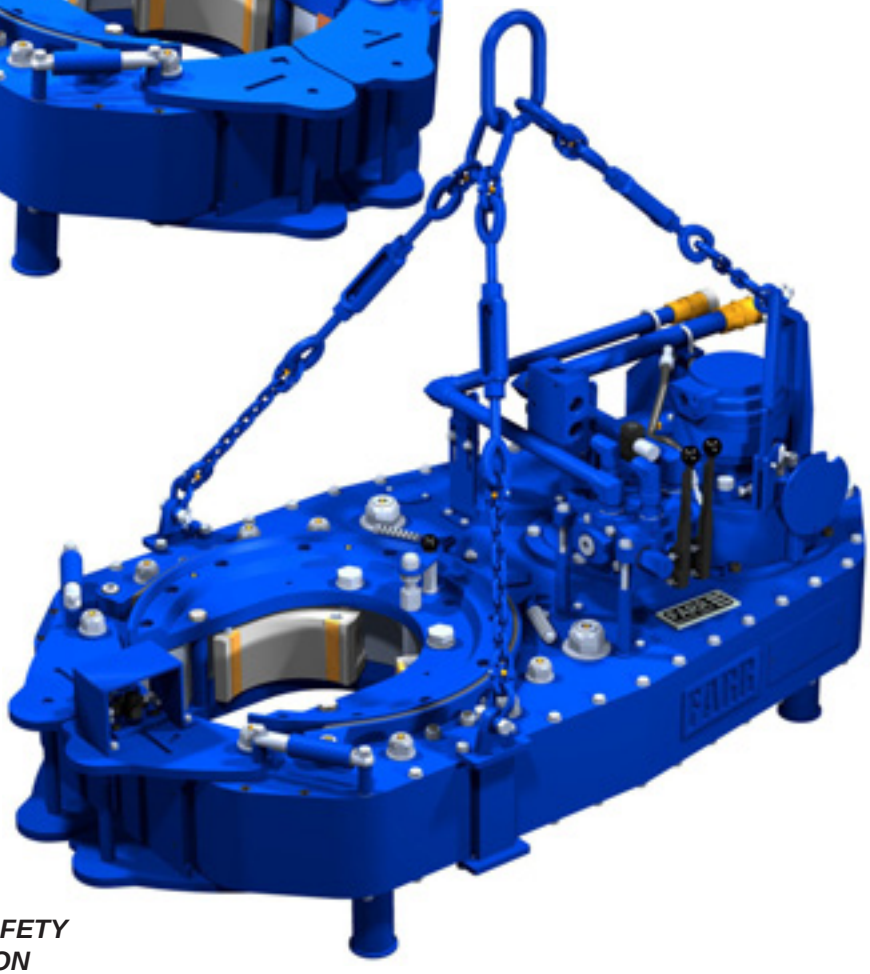
PARTS AND ASSEMBLIES

STANDARD TONG



TONG WITH SAFETY DOOR OPTION

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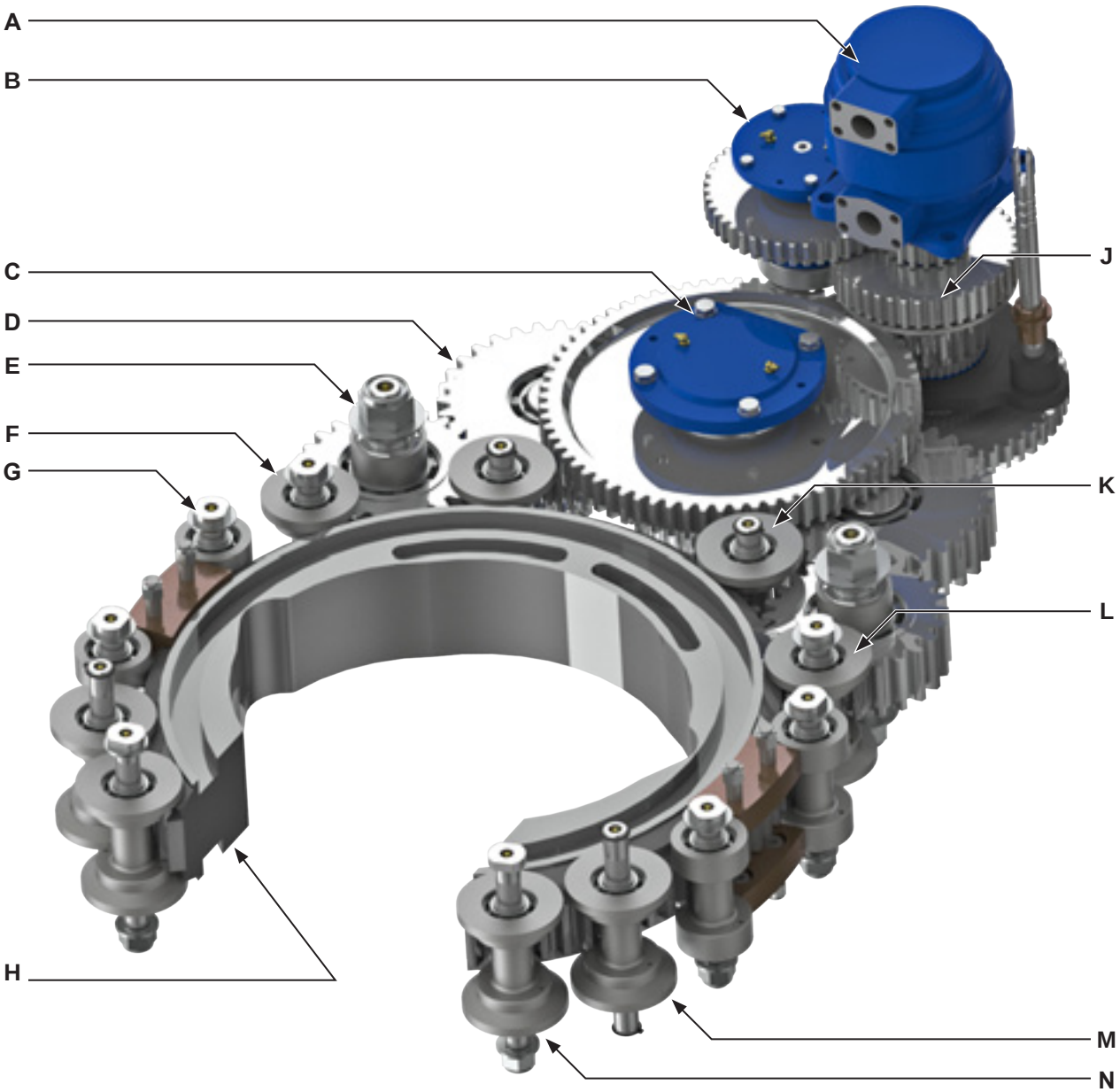

Item	Type	Description	Qty	Part Number
A	Part	Rineer GA37-26 Hydraulic Motor	1	87-0130
B	Assembly	Lay Gear Assembly (See Pp. 5.26 - 5.27)	1	
C	Assembly	Pinion Assembly (Pp. 5.22 - 5.23)	1	
D	Assembly	Pinion Idler Assembly (Pp. 5.20-5.21)	2	
E	Assembly	Rotary Idler Assembly (Pp. 5.18-5.19)	2	
F	Assembly	Support Roller (Turn Counter Clearance) (Pp. 5.8 - 5.9)	1	
G	Assembly	Support Roller A (Pp. 5.6 - 5.7)	4	
H	Part	Rotary Gear	1	1393-1
J	Assembly	Clutch Assembly (Pp. 5.24 - 5.25)	1	
K	Assembly	Low-Profile Support Roller (See Pp. 5.10 - 5.11)	2	
L	Assembly	Support Roller B (Pp.)	1	
M	Assembly	Support Roller (Brake band Support) (Pp. 5.12 - 5.13)	2	
N	Assembly	Door Pivot Support Roller (Pp. 5.14 - 5.15)	2	

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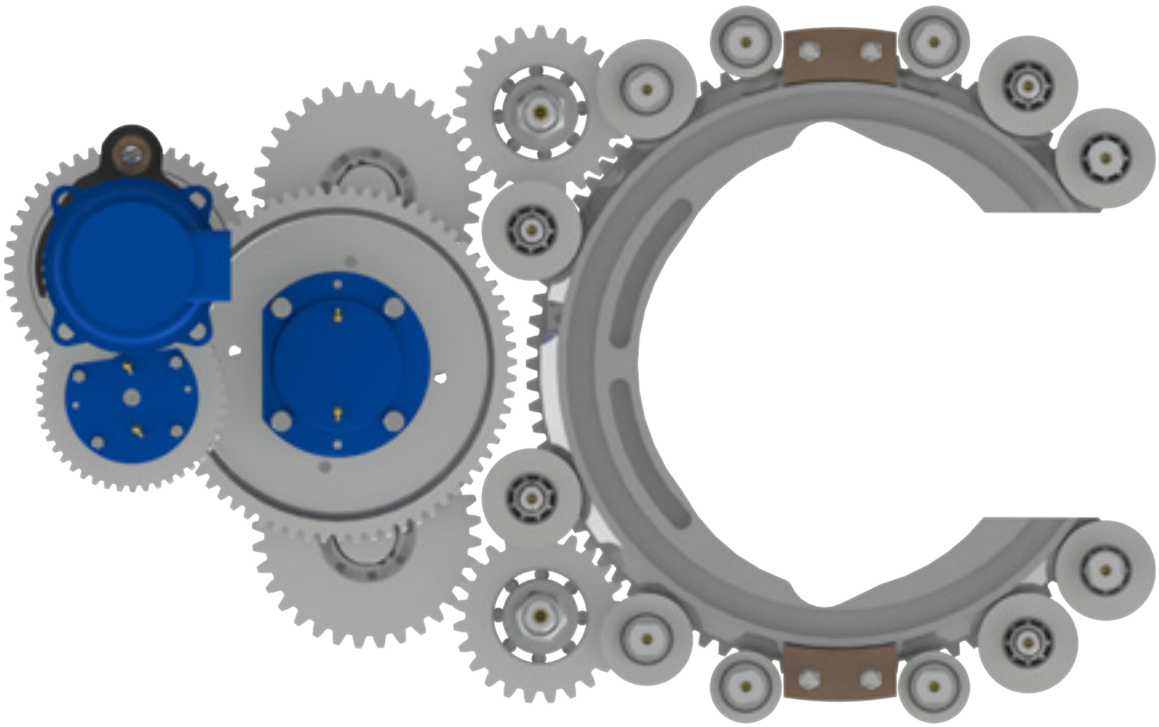

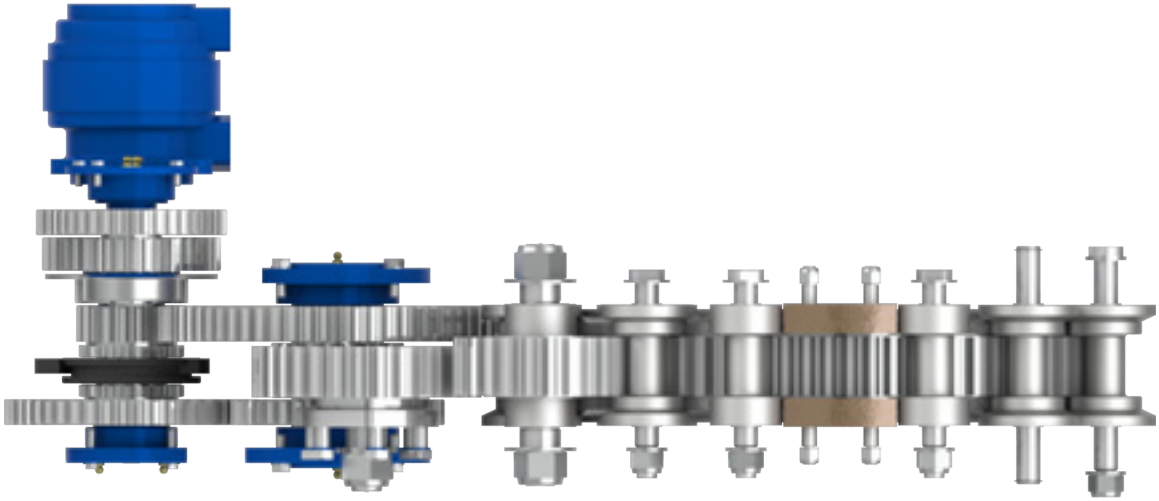

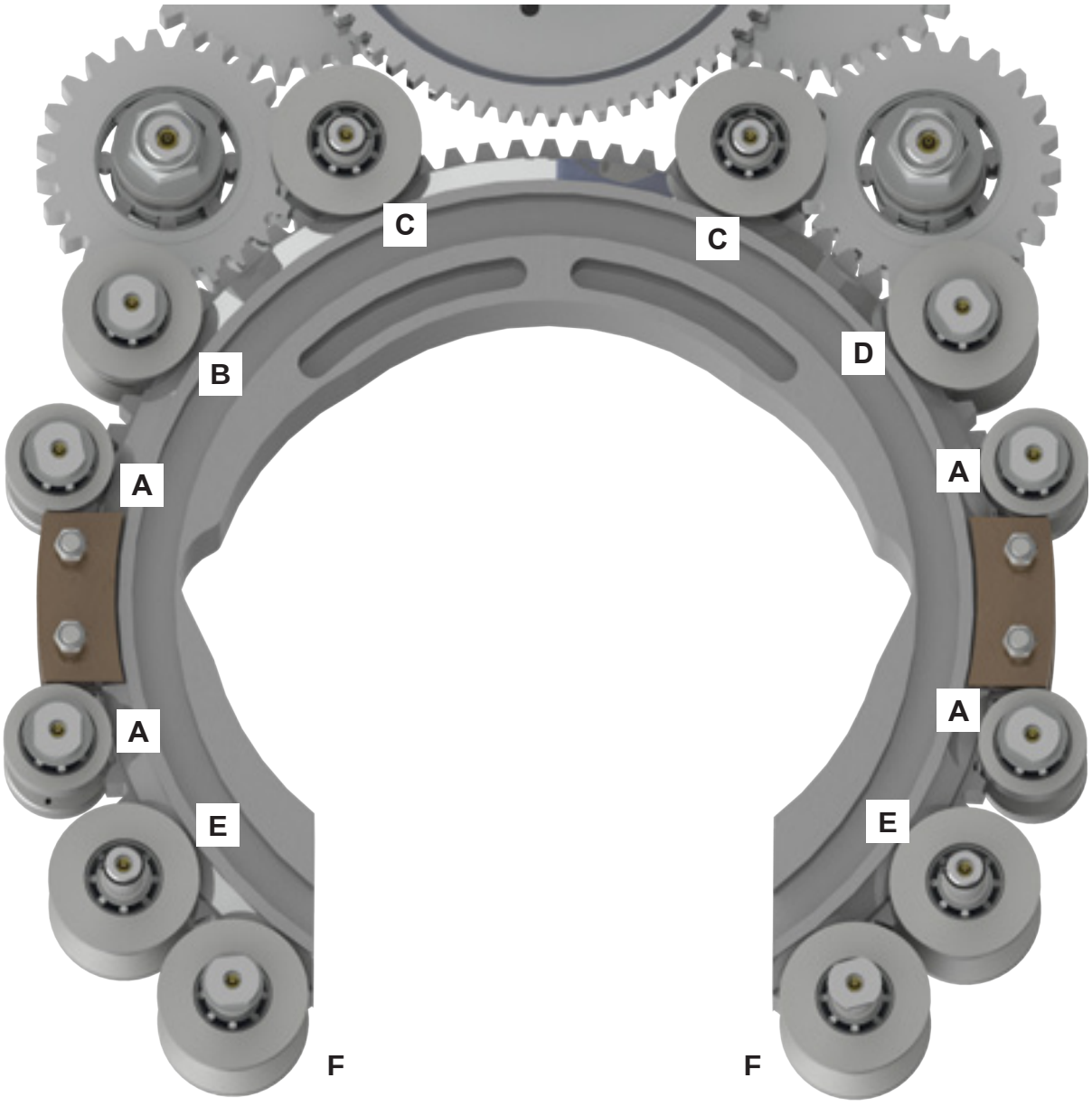

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Item	Type	Description	Qty	Part Number
A	Assembly	Support Roller A (Pp. 5.6 - 5.7)	4	
B	Assembly	Support Roller B (Turn Counter Clearance) (Pp. 5.8 - 5.9)	1	
C	Assembly	Support Roller C (Low Clearance) (Pp. 5.10 - 5.11)	2	
D	Assembly	Support Roller D (Pp. 5.12 - 5.13)	1	
E	Assembly	Support Roller E (Brake Band Support) (Pp. 5.14 - 5.15)	2	
F	Assembly	Door Pivot Support Roller (Pp. 5.16 - 5.17)	2	

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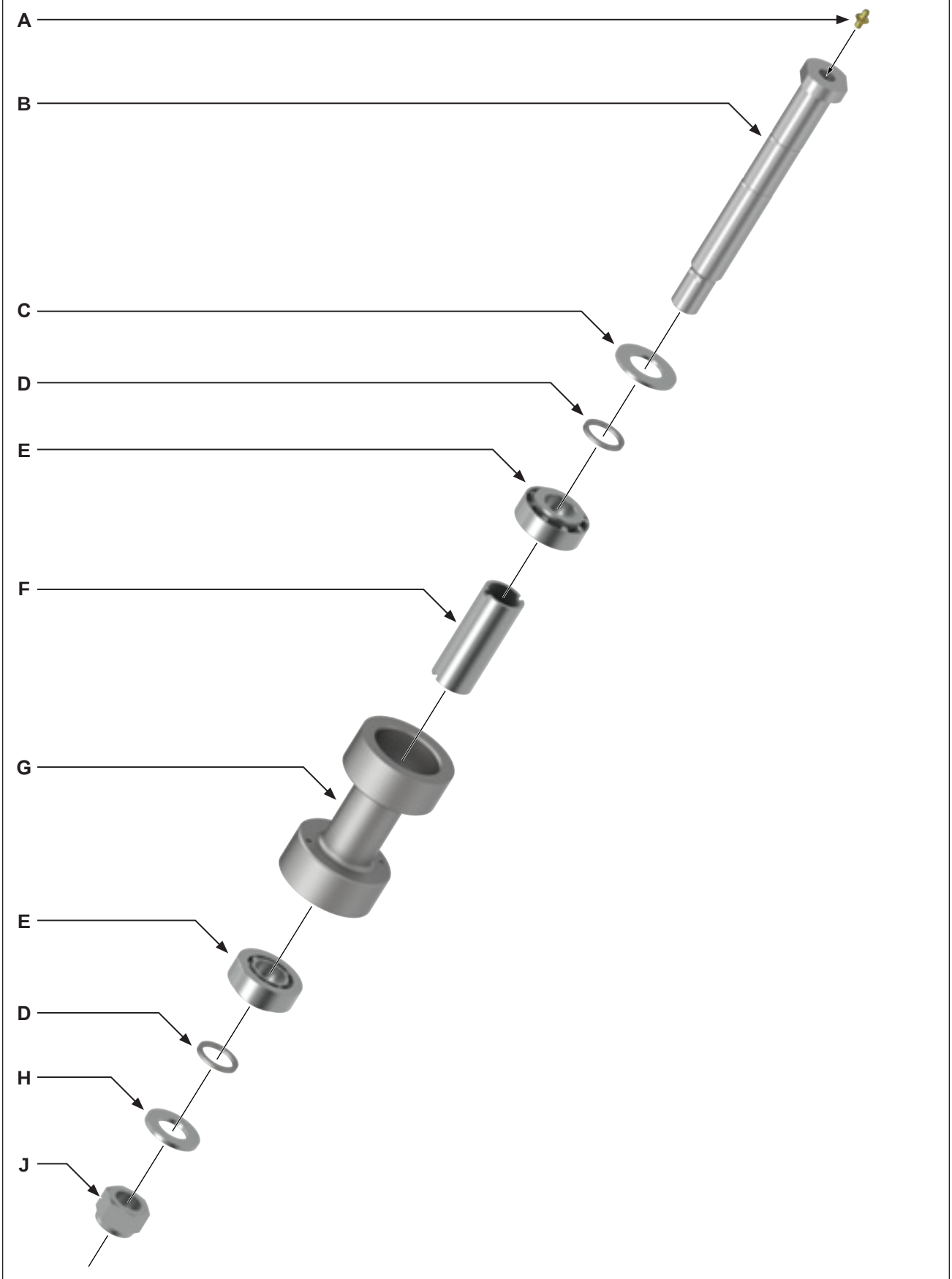

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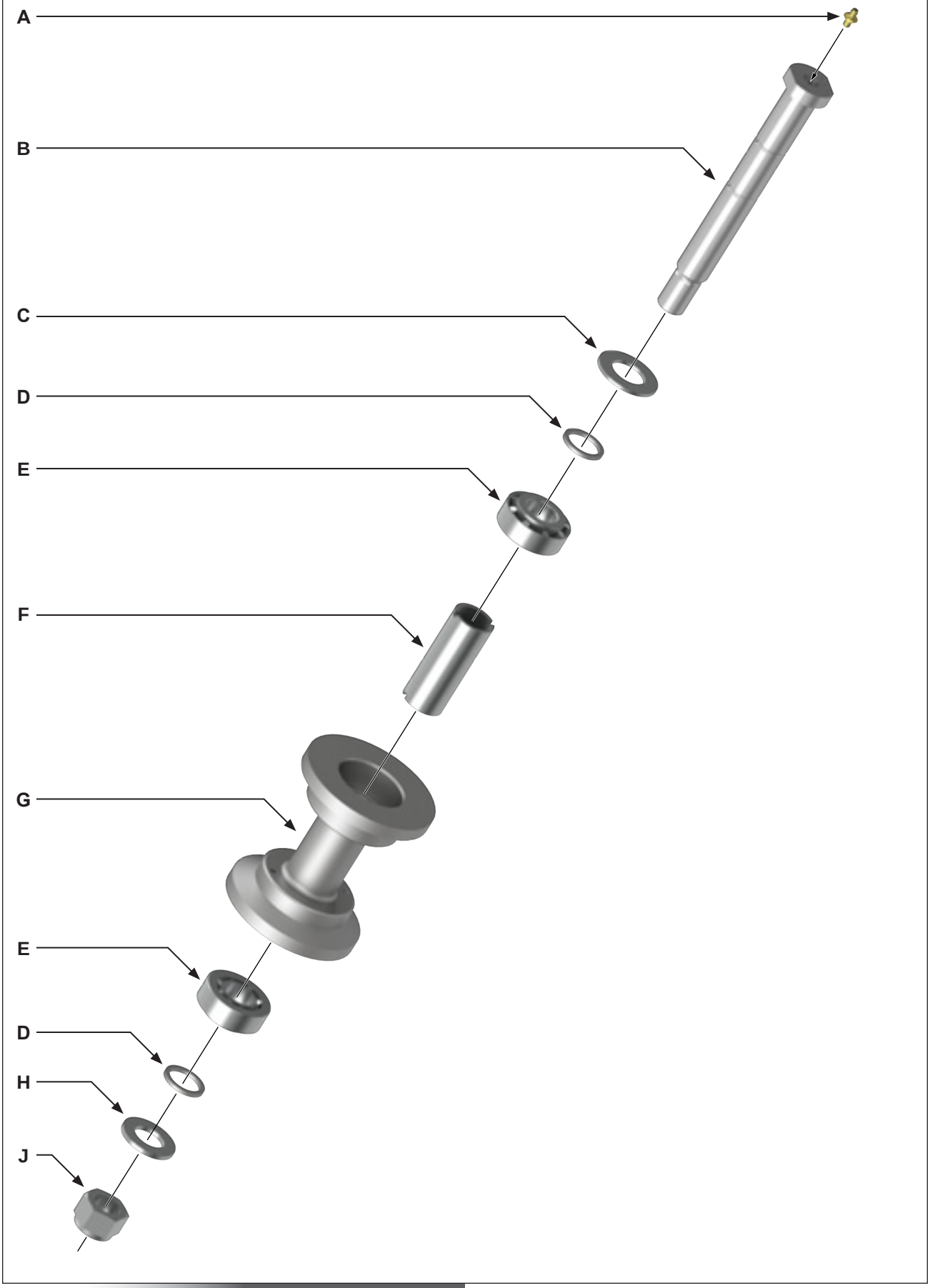
Item	Type	Description	Qty	Part Number
A	Part	1/4" UNF Straight Grease Fitting	1	02-0097
B	Part	Support Roller Shaft	1	101-3945
C	Part	1-1/8" Narrow Washer	1	09-5041
D	Part	Bearing Spacer	2	1393-140
E	Part	Tapered Roller Bearing	2	1393-136
F	Part	Support Roller Shaft Spacer	1	1393-134
G	Part	Support Roller	1	1393-135A
H	Part	1" Narrow Washer	1	09-5120
J	Part	1" UNS Hex Nylock Nut	1	09-9266



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Item	Type	Description	Qty	Part Number
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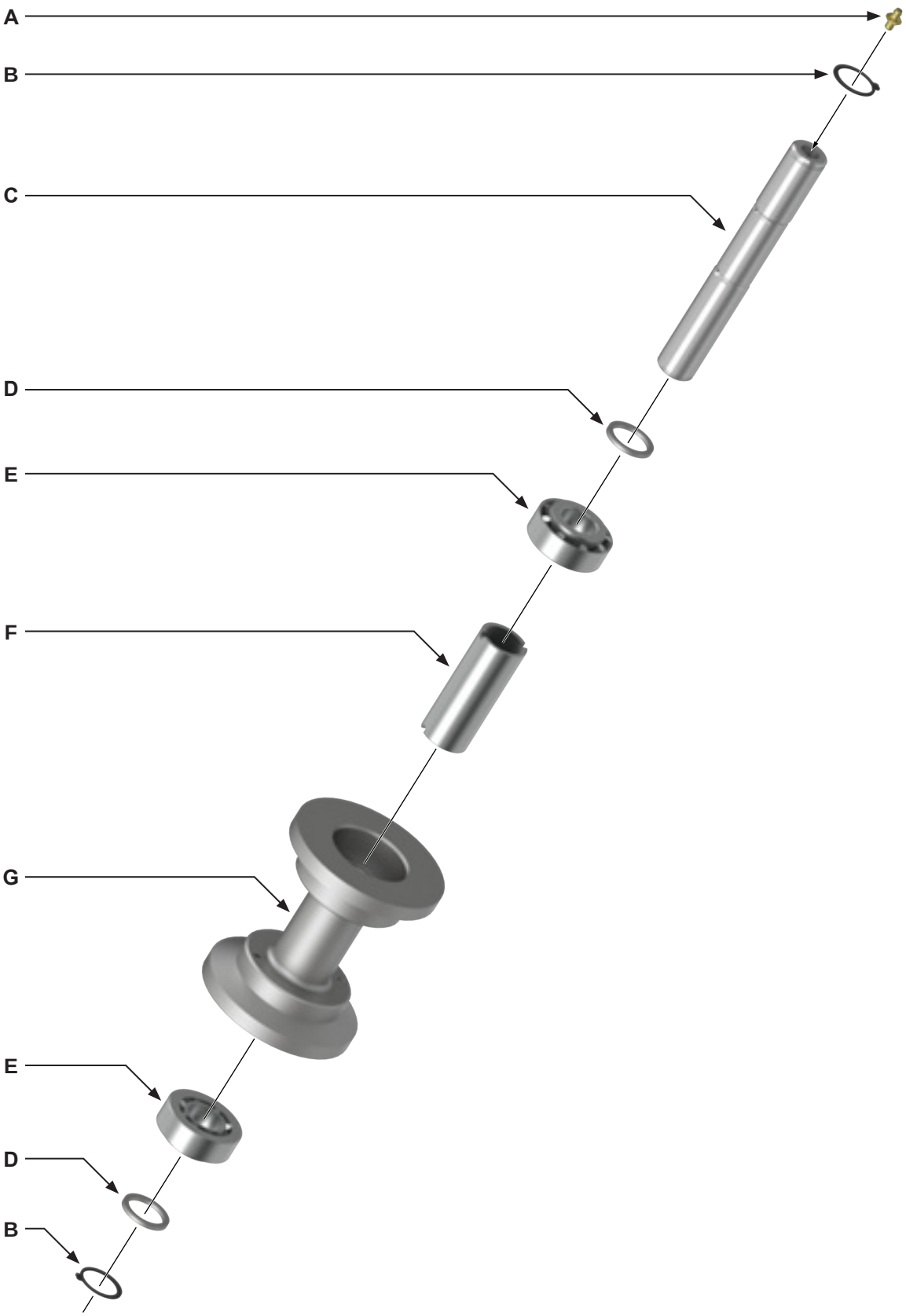
B	Part	Support Roller Shaft	1	101-3945
C	Part	1-1/8" Narrow Washer	1	09-5041
D	Part	Bearing Spacer	2	1393-140
E	Part	Tapered Roller Bearing	2	1393-136
F	Part	Support Roller Shaft Spacer	1	1393-134
G	Part	Support Roller	1	1393-135B
H	Part	1" Narrow Washer	1	09-5120
J	Part	1" UNS Hex Nylock Nut	1	09-9266



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Item	Type	Description	Qty	Part Number
A	Part	1/4" UNF Straight Grease Fitting	1	02-0097
B	Part	External Retaining Ring	2	1429-131-04
C	Part	Support Roller Shaft	1	1393-131-01
D	Part	Bearing Spacer	2	1393-140
E	Part	Tapered Roller Bearing	2	1393-136
F	Part	Support Roller Shaft Spacer	1	1393-134
G	Part	Support Roller	1	1393-135

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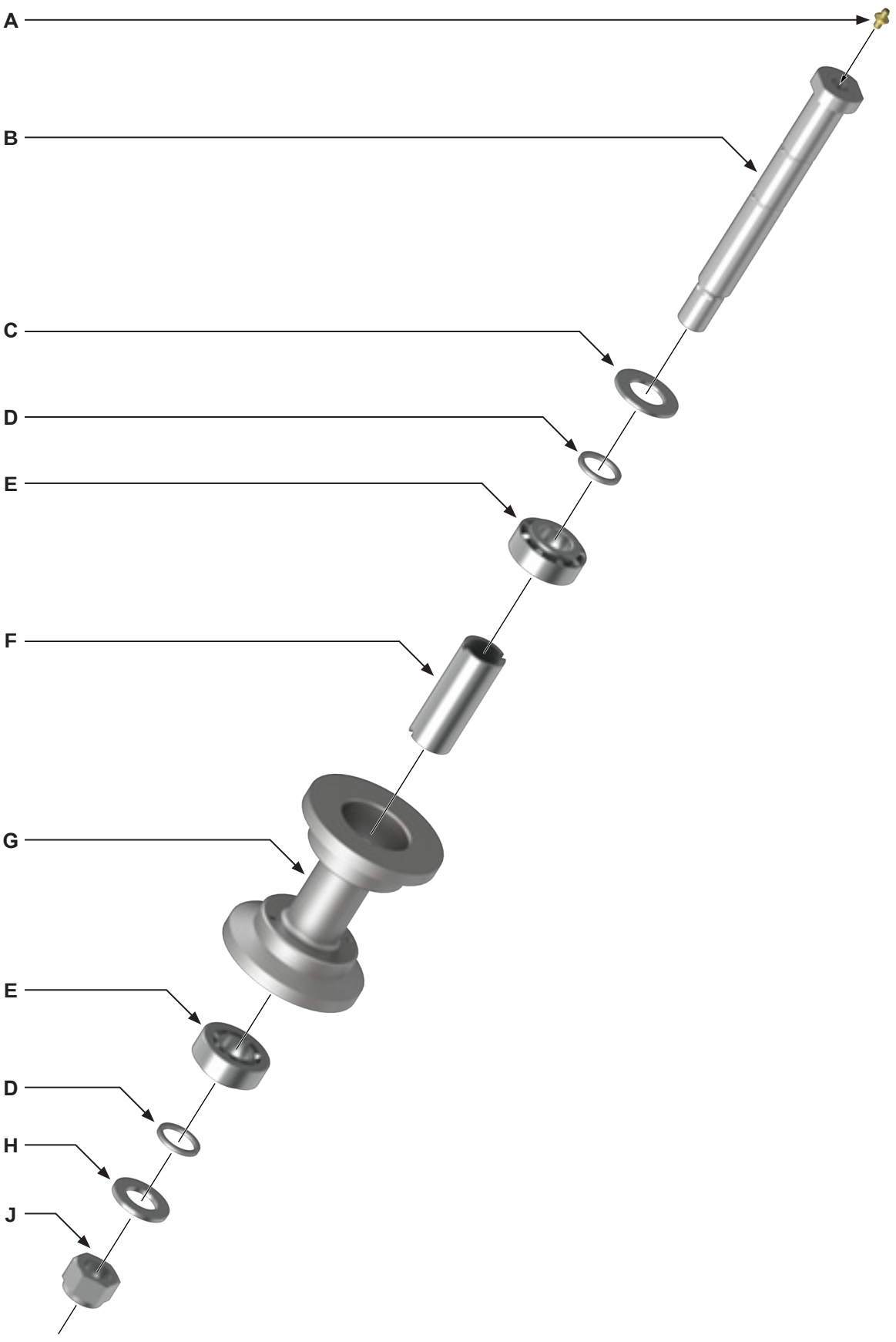

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Item	Type	Description	Qty	Part Number
A	Part	1/4" UNF Straight Grease Fitting	1	02-0097
B	Part	Support Roller Shaft	1	101-3945
C	Part	1-1/8" Narrow Washer	1	09-5041
D	Part	Bearing Spacer	2	1393-140
E	Part	Tapered Roller Bearing	2	1393-136
F	Part	Support Roller Shaft Spacer	1	1393-134
G	Part	Support Roller	1	1393-135
H	Part	1" Narrow Washer	1	09-5120
J	Part	1" UNS Hex Nylock Nut	1	09-9266

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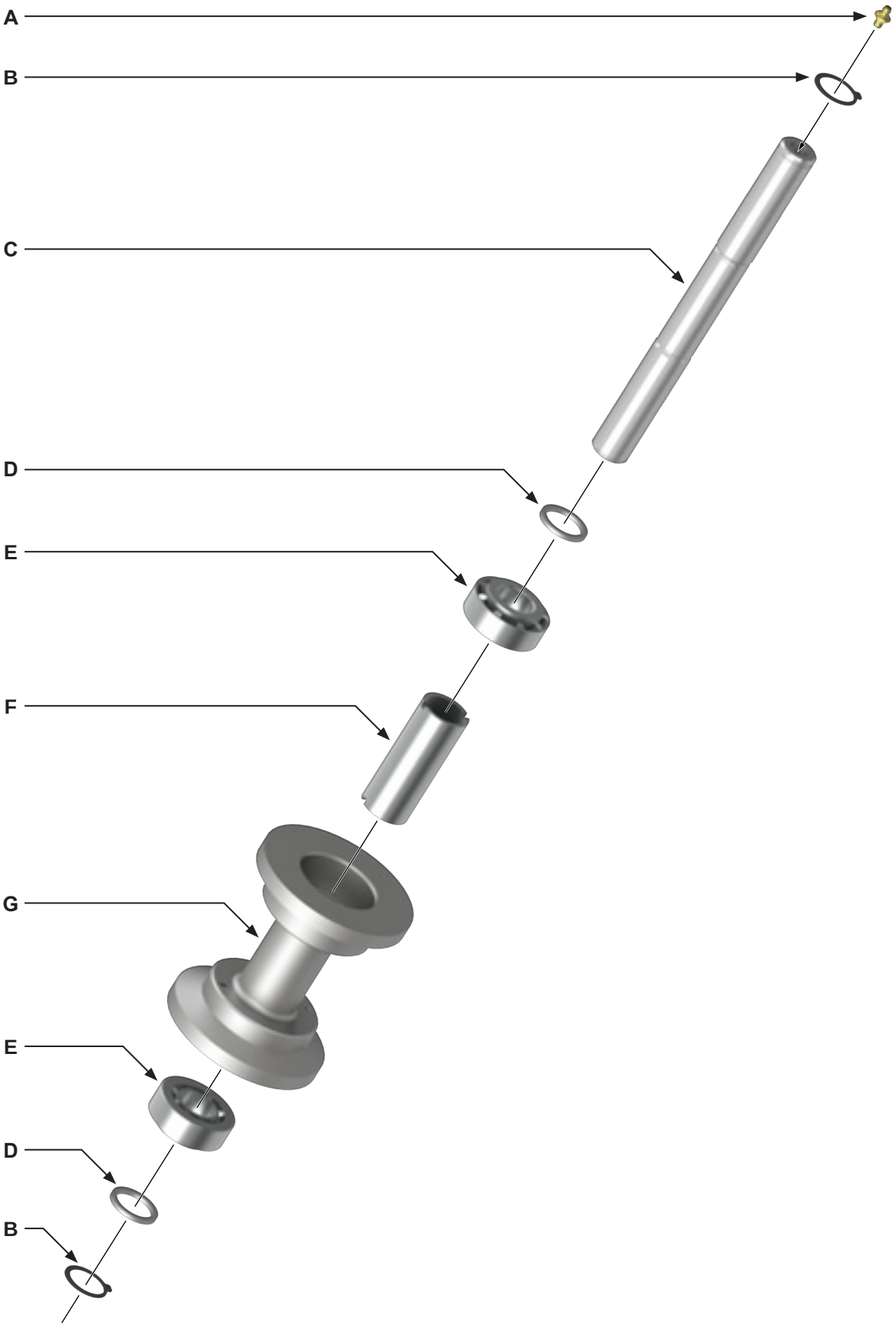

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Item	Type	Description	Qty	Part Number
A	Part	1/4” UNF Straight Grease Fitting	1	02-0097
B	Part	External Retaining Ring	2	1429-131-04
C	Part	Support Roller Shaft	1	1393-131-02
D	Part	Bearing Spacer	2	1393-140
E	Part	Tapered Roller Bearing	2	1393-136
F	Part	Support Roller Shaft Spacer	1	1393-134
G	Part	Support Roller	1	1393-135

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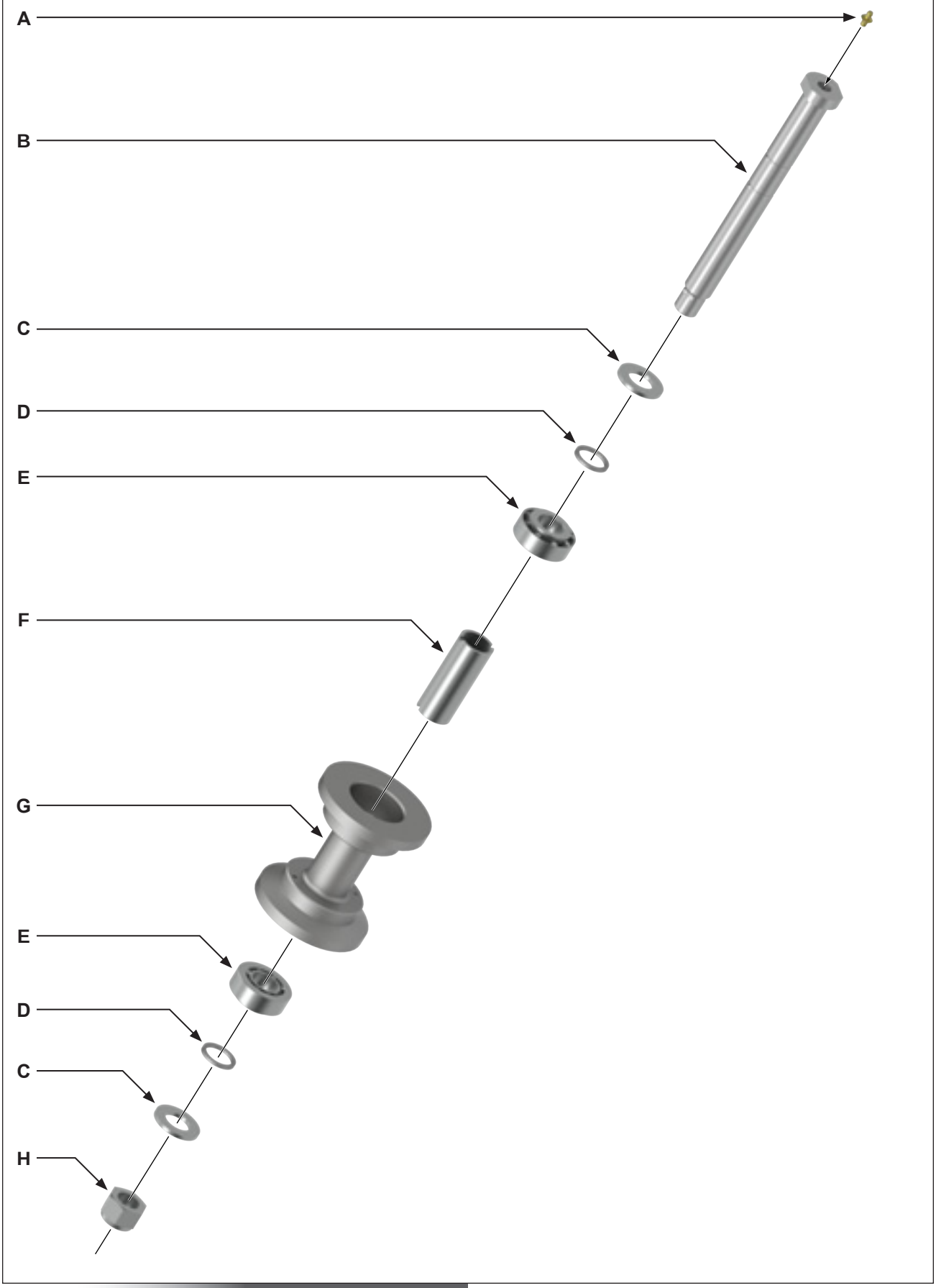
A
B
C
D
E
F
G
E
D
C
H

Item	Type	Description	Qty	Part Number
A	Part	1/4” UNF Straight Grease Fitting	1	02-0097
B	Part	Support Roller Shaft	1	101-3946
C	Part	1” Narrow Washer	2	09-5120
D	Part	Bearing Spacer	2	1393-140
E	Part	Tapered Roller Bearing	2	1393-136
F	Part	Support Roller Shaft Spacer	1	1393-134
G	Part	Support Roller	1	1393-135
H	Part	1” UNS Hex Nylock Nut	1	09-9266

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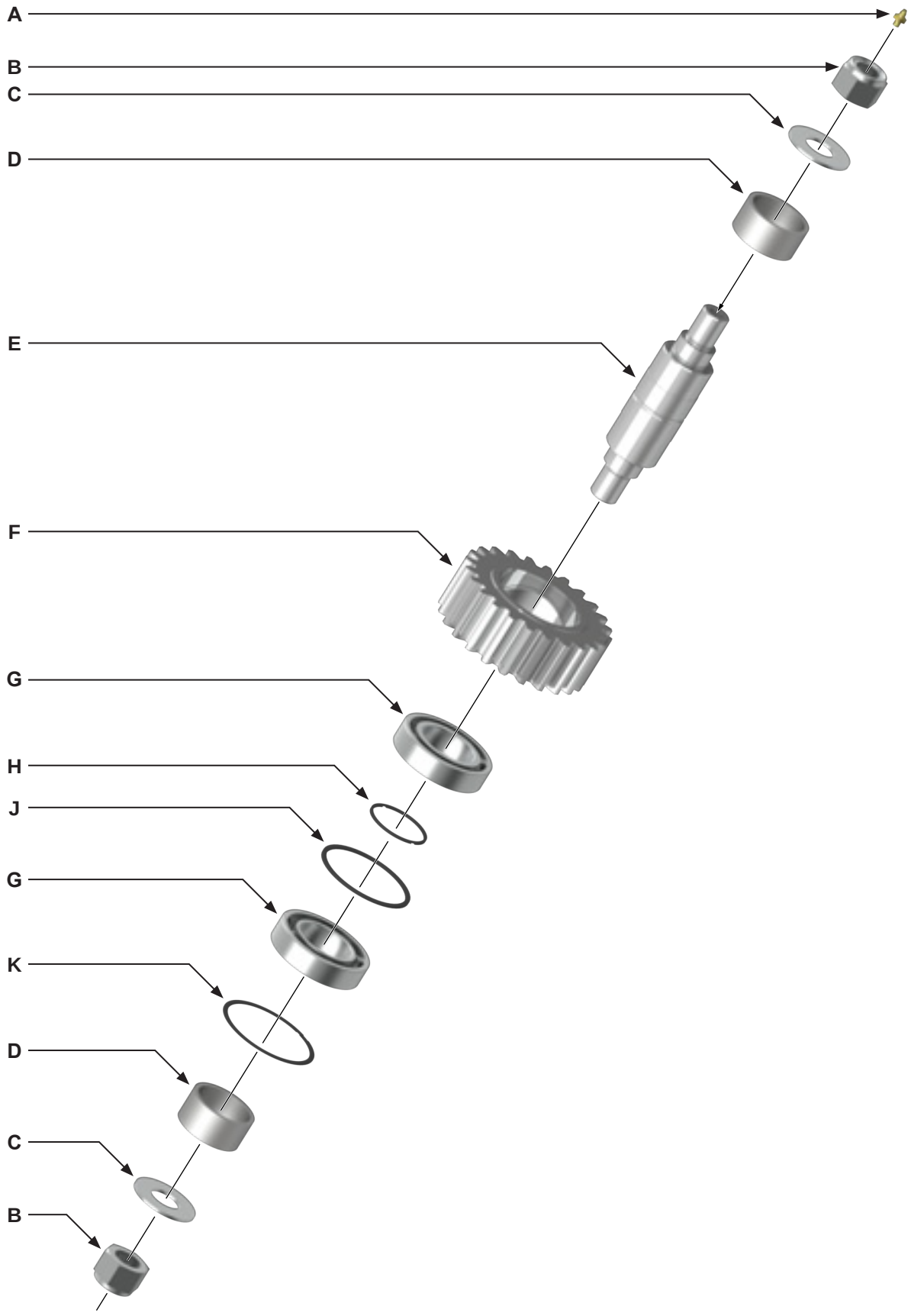

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Item	Type	Description	Qty	Part Number
A	Part	Grease Fitting, 1/8” NPT	1	02-0005
B	Part	1-1/2” UNF Nylock Nut	2	09-5740
C	Part	1-1/2” Washer	2	09-5040
D	Part	Idler Gear Spacer	2	1393-121
E	Part	Rotary Idler Shaft	1	1393-117
F	Part	Cylindrical Roller Bearing	2	1393-106
G	Part	Outer Idler Spacer	1	1393-109
H	Part	Inner Idler Spacer	1	1393-108
J	Part	Outer Idler Spacer	1	1393-109
K	Part	Retainer Ring	1	1393-110

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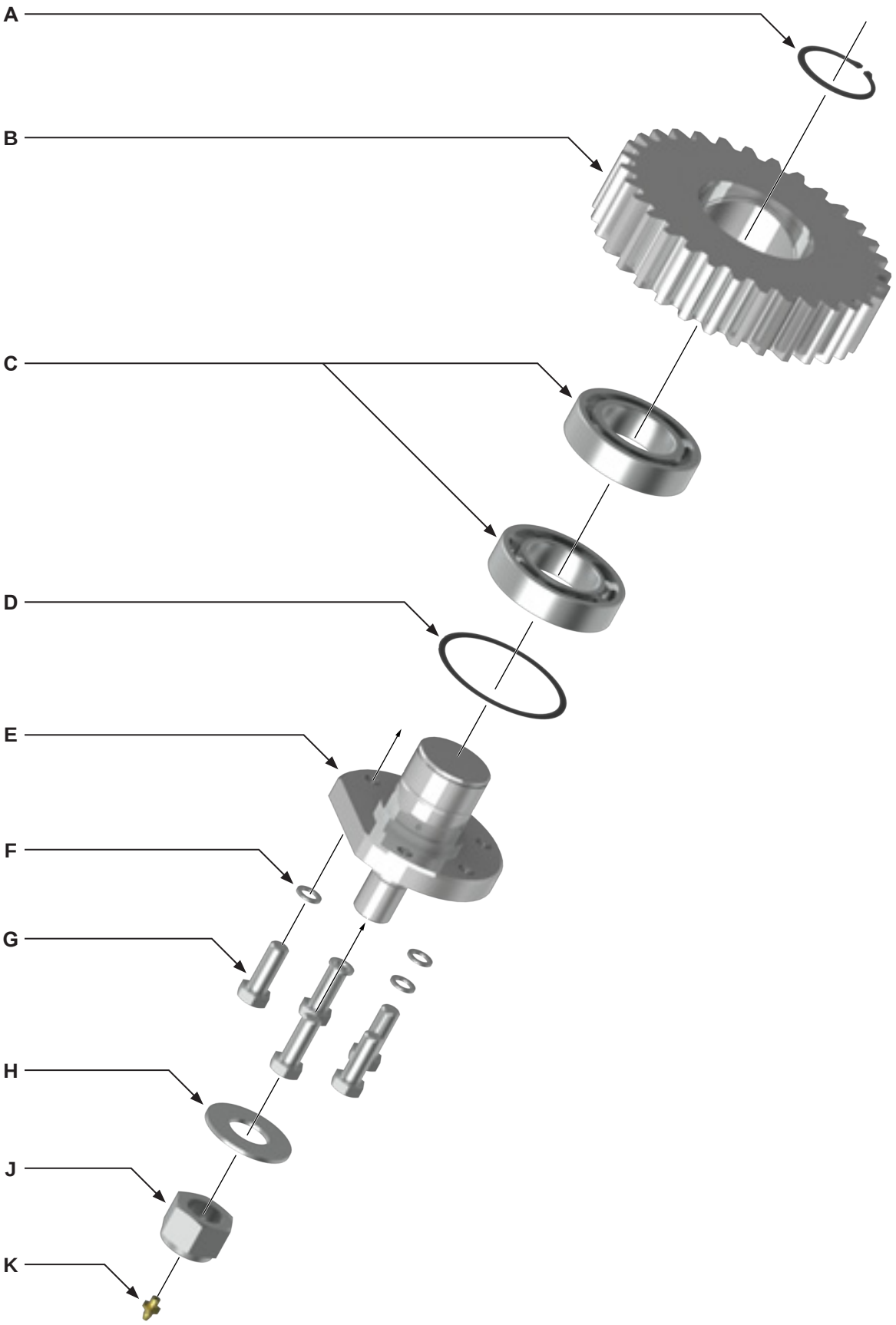

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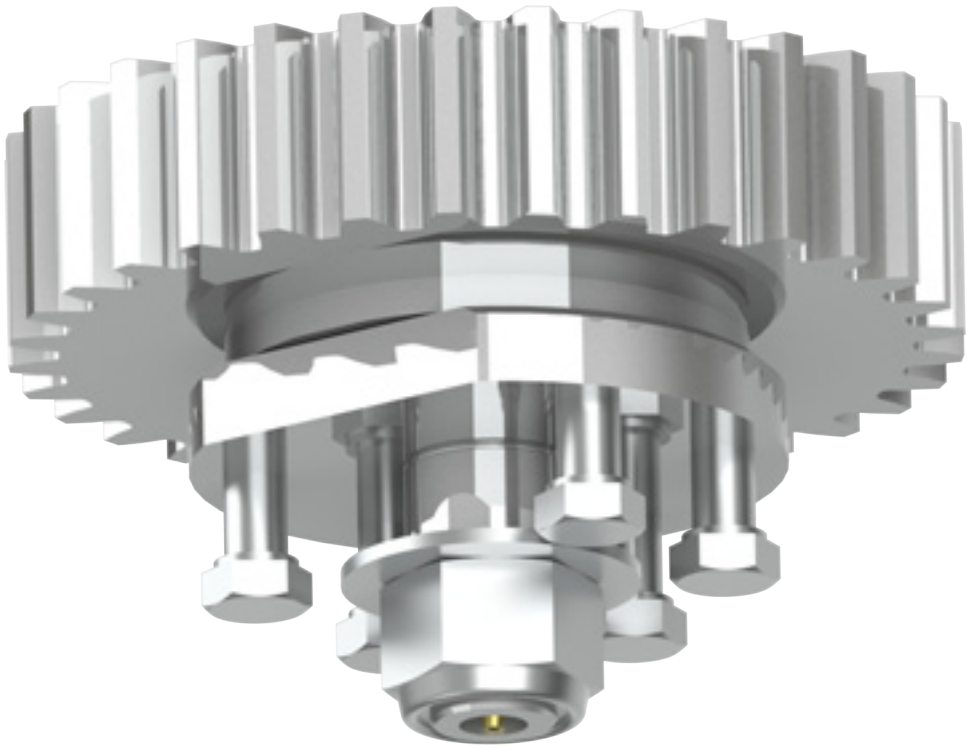

Item	Type	Description	Qty	Part Number
A	Part	External Retaining Ring	1	1374-110
B	Part	Idler Gear	1	1393-120
C	Part	Roller Bearing	2	1393-106
D	Part	Retainer Ring	1	1393-110
E	Part	Pinion Idler Half Shaft	1	1393-105
F	Part	3/4” Lock washers	5	09-5118
G	Part	3/4” NC x 2” Hex Bolt	5	09-1294
H	Part	Half-shaft Spacer	1	1393-105-1
J	Part	1-1/2” NC Nylock Nut	1	09-5739
K	Part	Grease Fitting	1	02-0005

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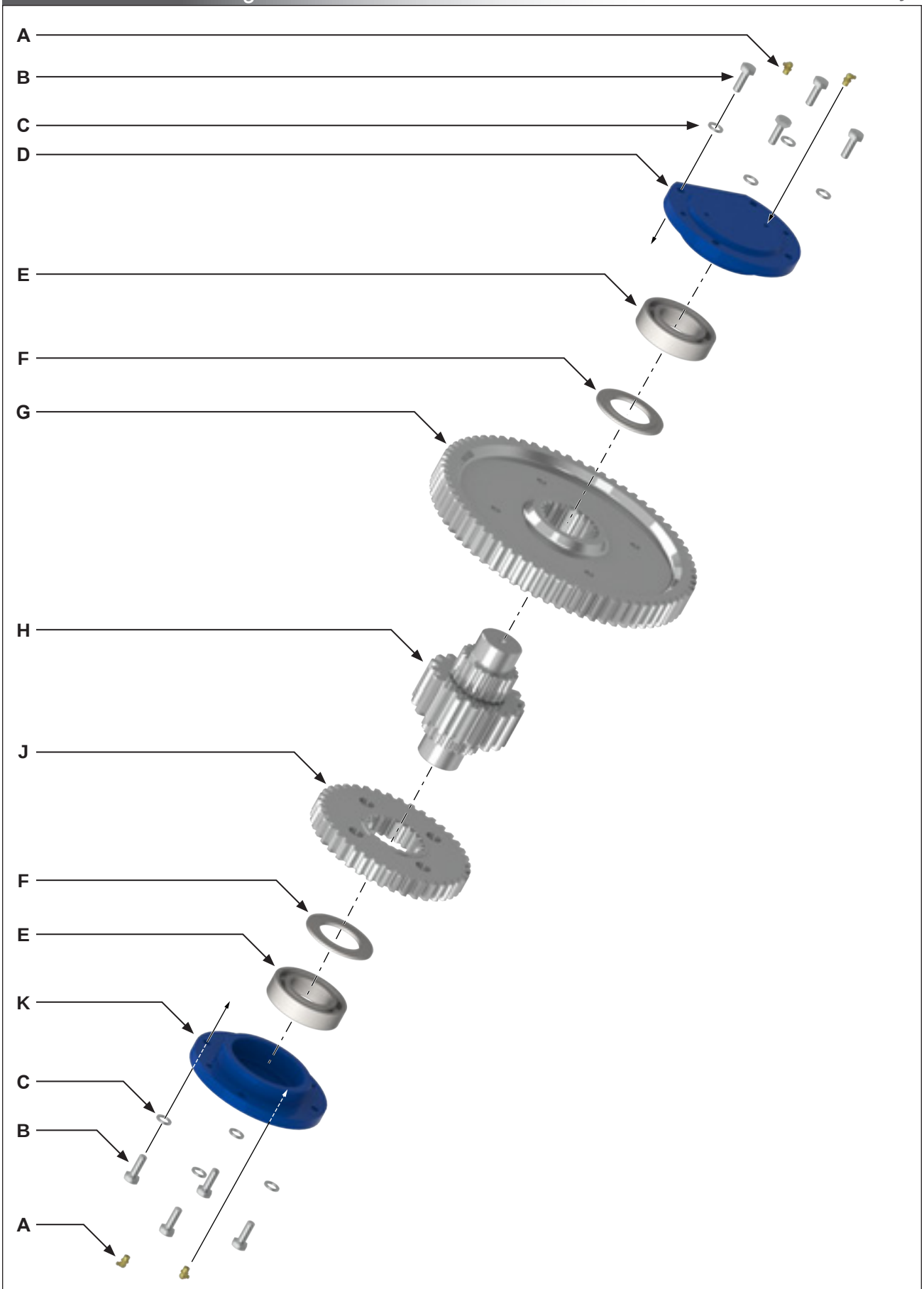

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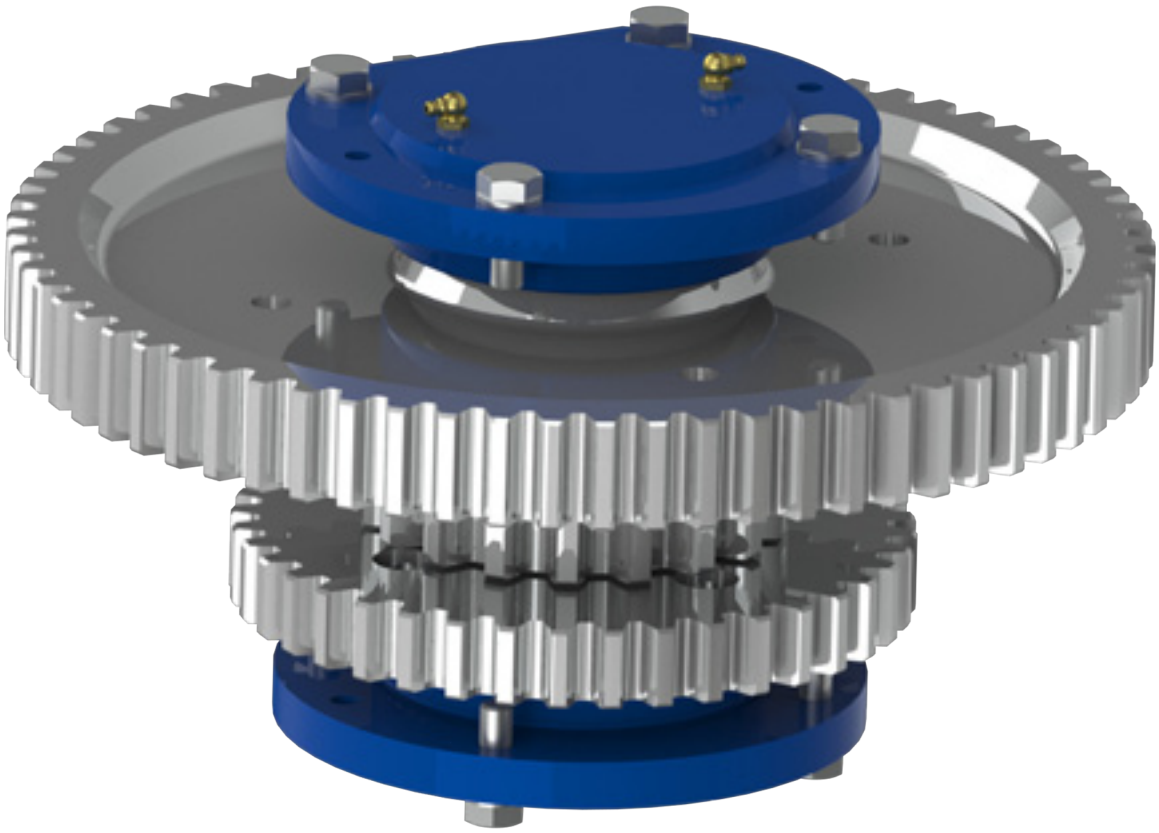

Item	Type	Description	Qty	Part Number
A	Part	1/8” NPT 90 Degree Grease Fitting	4	02-0093
B	Part	1/2” NC x 1-1/2” Hex Bolt	8	09-1170
C	Part	1/2” Lock Washer	8	09-5110
D	Part	Top Pinion Bearing Cap	1	1393-89
E	Part	Pinion Bearing	2	1393-93
F	Part	Pinion Gear Spacer	2	1393-94
G	Part	Upper Pinion Gear	1	1393-88
H	Part	Pinion Gear	1	1393-86
J	Part	Lower Pinion Gear	1	1393-87
K	Part	Lower Pinion Bearing Cap	1	1393-89A

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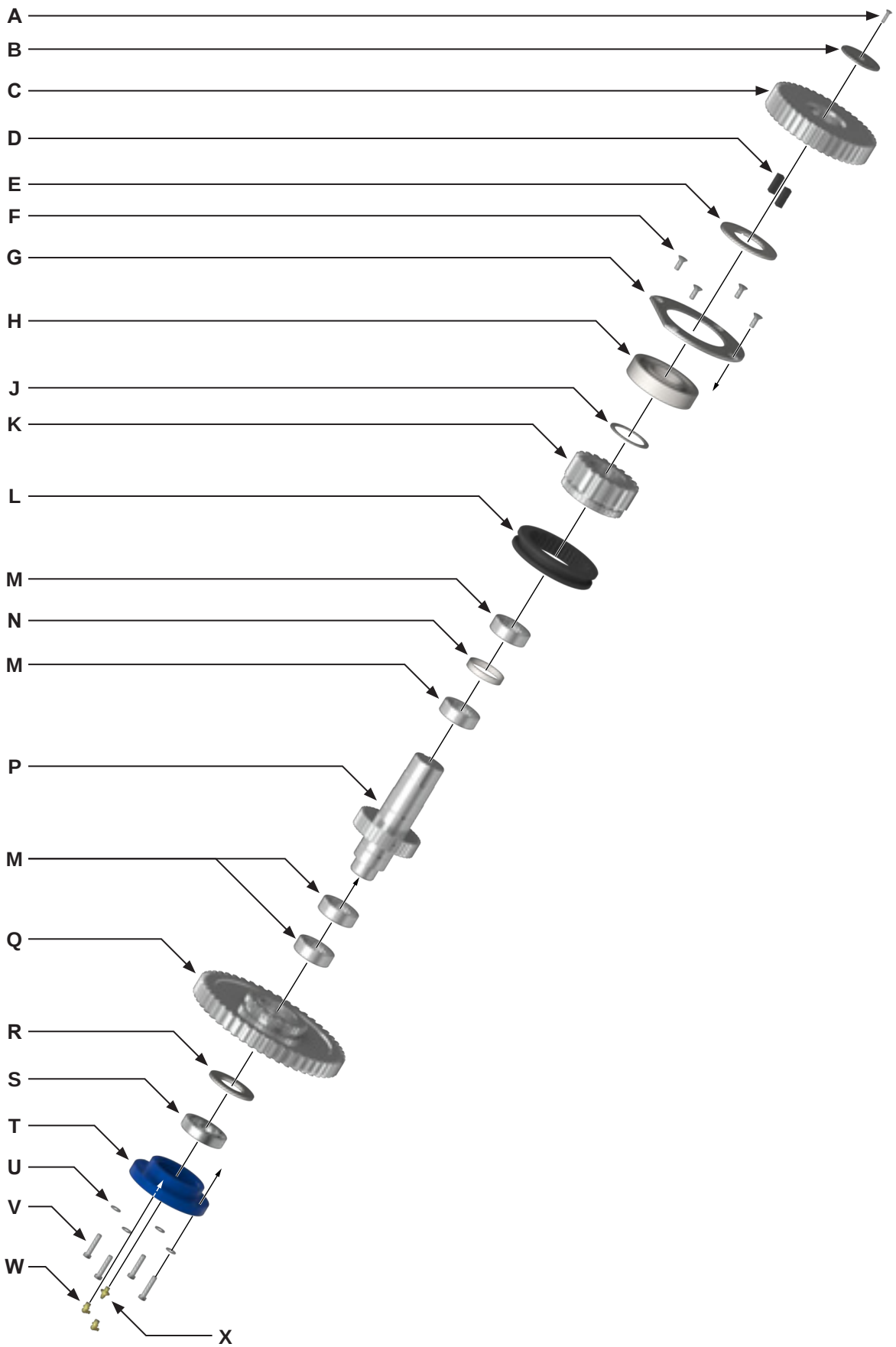

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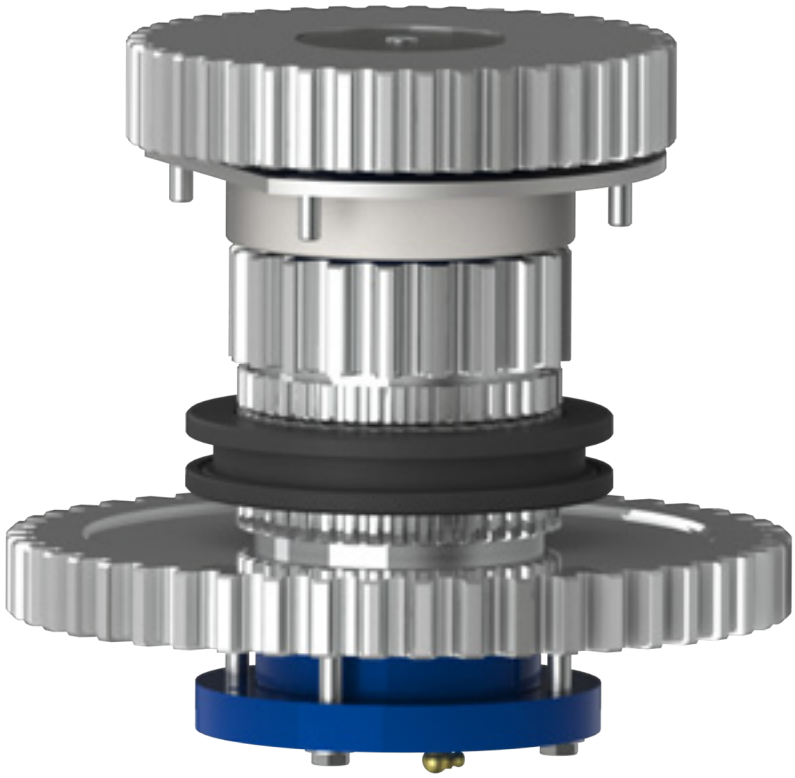
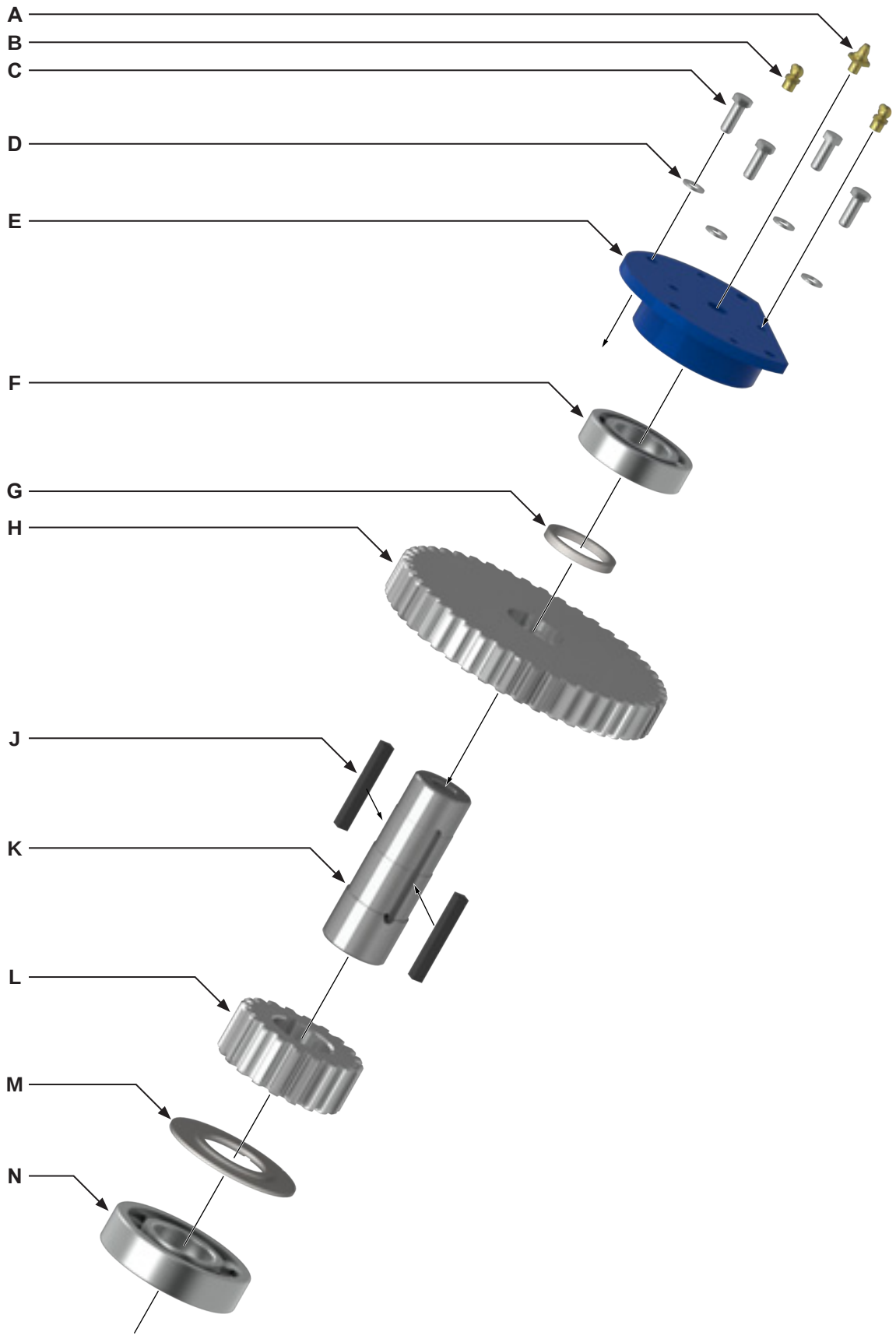


Item	Type	Description	Qty	Part Number
A	Part	1/4” NC x 1” Hex Socket Flat Head Machine Screws	1	09-4007
B	Part	Clutch Shaft Plate	1	1393-50-04
C	Part	Clutch Drive Gear	1	1393-61
D	Part	Gear Key	2	101-1947
E	Part	Clutch Shaft Spacer	1	1393-50-03
F	Part	3/8” NC x 1” Hex Socket Flat Head Machine Screws	4	09-4046
G	Part	Clutch Bearing Plate	1	1393-57
H	Part	Top Clutch Shaft Bearing	1	1393-56
J	Part	Clutch Shaft Spacer	1	1393-50-01
K	Part	Low Clutch Gear	1	1393-52
L	Part	Shifting Collar	1	1393-62
M	Part	Clutch Gear Needle Bearing	4	1393-53
N	Part	Inner Spacer	1	1393-52-01
P	Part	Clutch Shaft	1	1393-50
Q	Part	High Clutch Gear	1	1393-51
R	Part	Clutch Shaft Spacer	1	1393-50-02
S	Part	Lower Clutch Bearing	1	1393-55
T	Part	Clutch Bearing Cap	1	1393-54
U	Part	3/8” NC X 1-3/4” Hex Bolt	4	09-1557
V	Part	3/8” Lock Washers	4	09-5106
W	Part	1/8” NPT 90 Degree Grease Fitting	2	02-0093
X	Part	1/8” NPT Grease Fitting	1	02-0005



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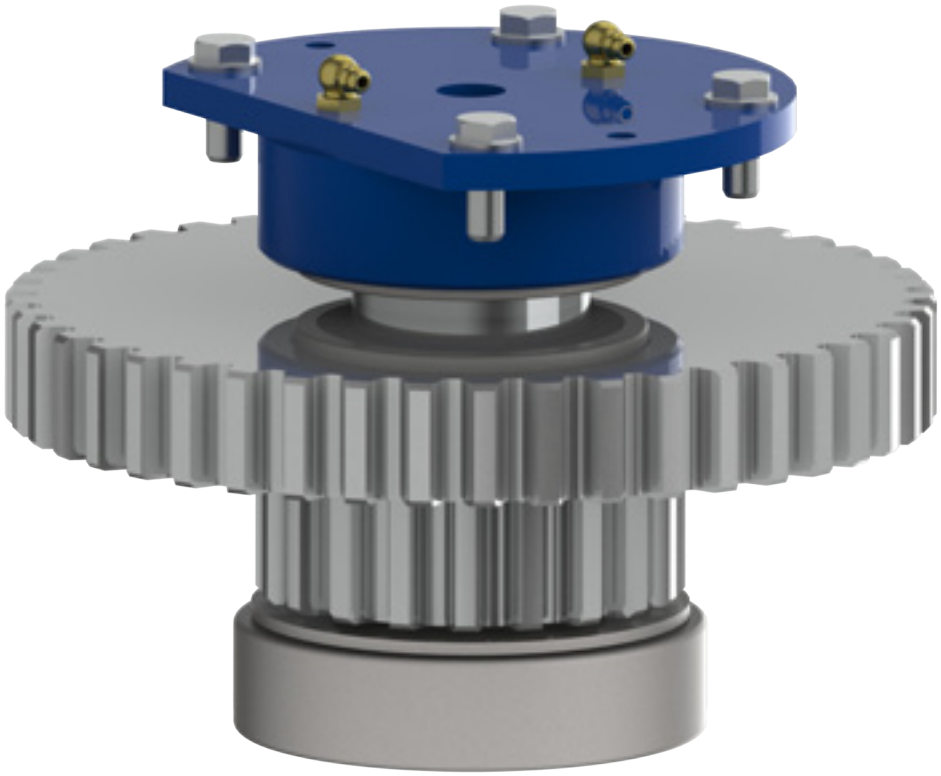

Item	Type	Description	Qty	Part Number
A	Part	1/8” NPT Grease Fitting	1	02-0005
B	Part	1/8” NPT 90 Degree Grease Fitting	2	02-0093
C	Part	3/8” NC X 1” Hex Bolt	4	09-1170
D	Part	3/8” Lock Washer	4	09-5106
E	Part	Lay Gear Bearing Cap	1	1393-151
F	Part	Bearing	1	1393-151-04
G	Part	Spacer	1	1393-82-03
H	Part	Lay Gear	1	1393-81
J	Part	Square Gear Key	2	50-1220-3000
K	Part	Lay Gear Shaft	1	1393-82
L	Part	Drive Shaft Pinion Gear	1	1393-80
M	Part	Bottom Spacer	1	1393-82-04
N	Part	Bottom Drive Shaft Bearing	1	1393-152

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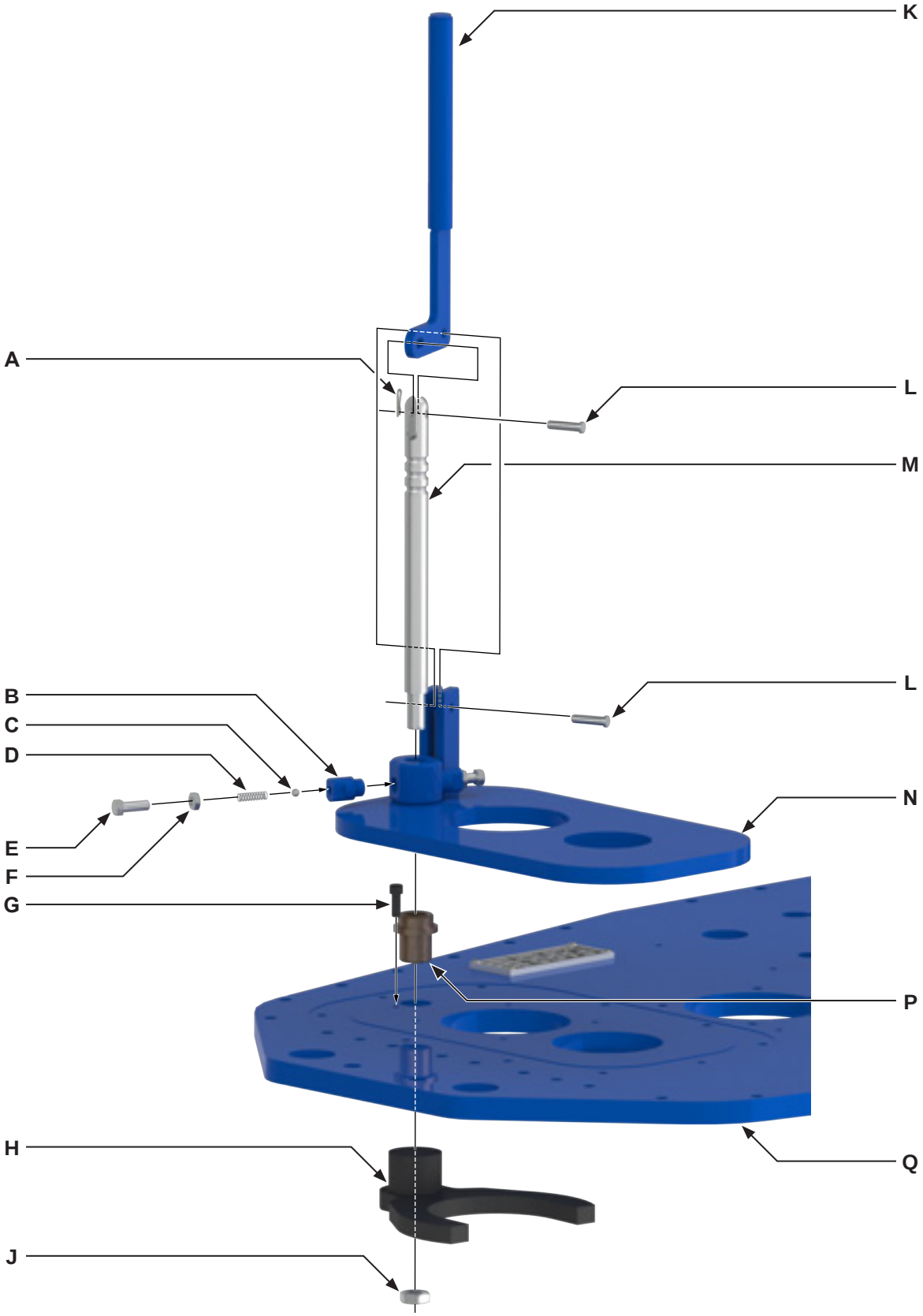

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Item	Type	Description	Qty	Part Number
A	Part	0.093” x 1-1/8” Hitch Pin	2	
B	Part	Threaded Shifter Detent Tube	2	101-1497
C	Part	Shifter Detent Ball	2	02-0018
D	Part	Shifter Detent Spring	2	997-0-64
E	Part	7/16” UNF x 1-1/4” Hex Bolt	2	09-1608
F	Part	7/16” UNF Hex Nut	2	09-5908
G	Part	3/8” x 1” Thin Head Hex SHCS	1	
H	Weldment	Shifting Fork Weldment	1	1393-72
J	Part	3/4” NC Nylock Nut	1	1429-39-02
K	Weldment	Shifter Handle	1	101-1749
L	Part	3/8” x 1-1/2” Clevis Pin	2	09-7116
M	Part	Shifting Shaft	1	1393-71
N	Part	Top Motor Mount Plate - Shown For Illustration Purposes Only		
P	Part	Lower Shifter Bushing	1	1393-78
Q	Part	Top Tong Plate - Shown For Illustration Purposes Only		

***ASSEMBLY NOTE**: The top shifter bushing, PN 101-1496, and the pivot arms, PN 1393-76, are typically welded to the motor mount housing weldment, PN 101-1808.*

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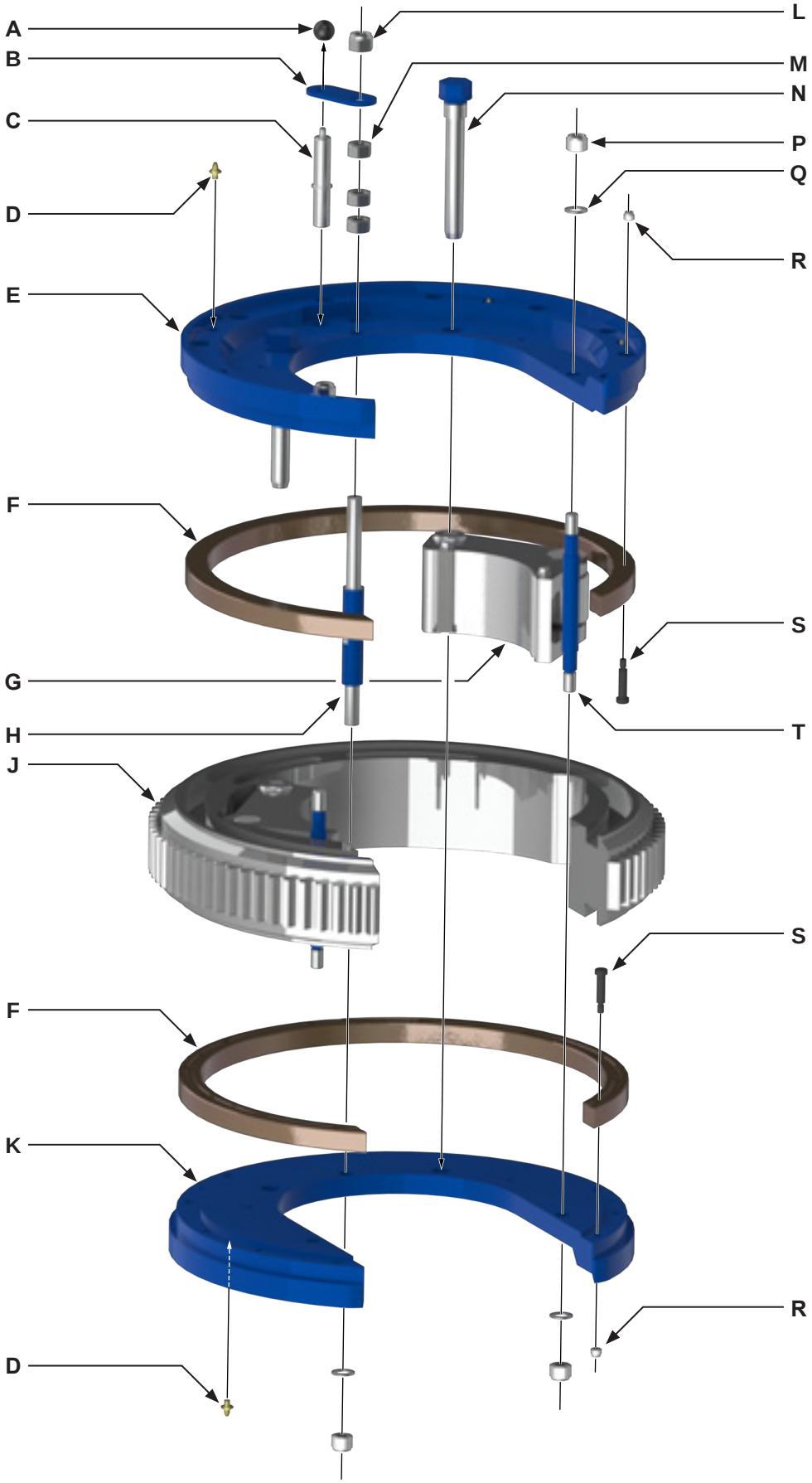

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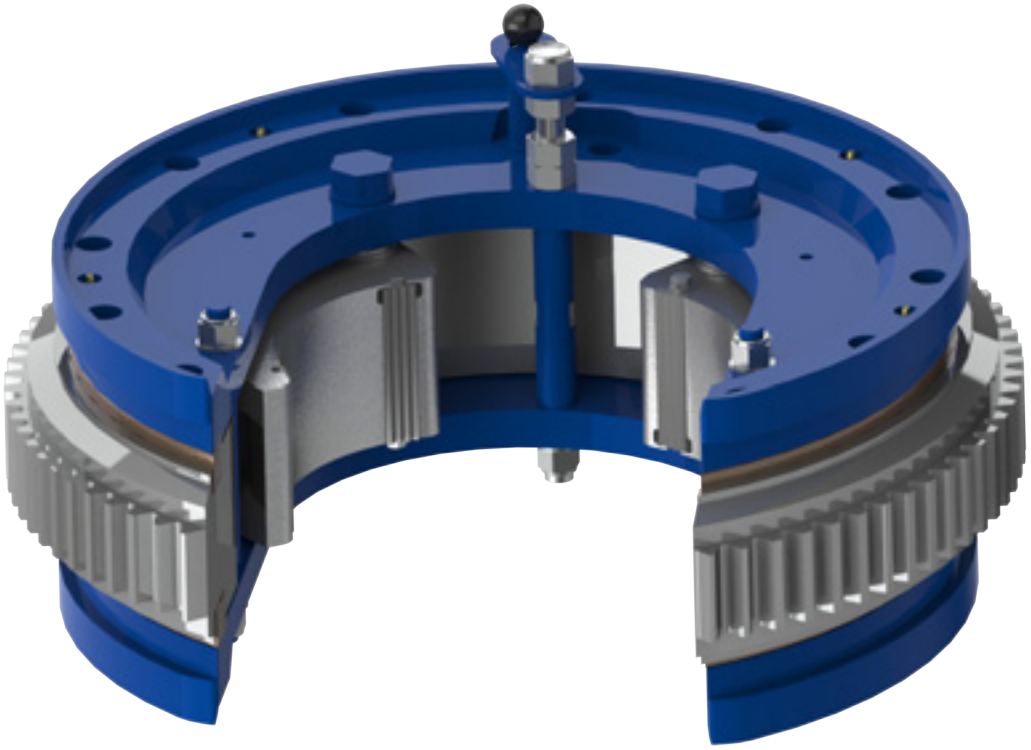

Item	Type	Description	Qty	Part Number
A	Part	Backing Pin Knob	1	02-0017
B	Part	Backing Pin Retainer	1	1393-40
C	Part	Backing Pin	1	1393-39
D	Part	1/8 “ NPT Grease Fitting	8	02-0005
E	Part	Top Cage Plate	1	1393-21
F	Part	Guide Ring	2	1393-23
G	Assembly	Jaw Assembly (11” shown)	2	See Pp. 2.13
H	Part	Rear Cage Plate Bolt/Spacer	1	1393-36
J	Part	Rotary Gear	1	1393-1
K	Part	Bottom Cage Plate	1	1393-22
L	Part	7/8” UNC Nylock Nut	1	09-5721
M	Part	7/8” UNC Hex Nut	3	09-5822
N	Part	Jaw Pivot Bolt	2	1393-28
P	Part	3/4” UNC Nylock Nut	5	1429-39-02
Q	Part	3/4” Narrow Flat Washer	5	09-5013
R	Part	3/8” NC Nylock Nut	22	09-5607
S	Part	1/2” x 1-3/4” Shoulder Bolt	22	09-0103
T	Part	Front Cage Plate Spacer	2	101-3630

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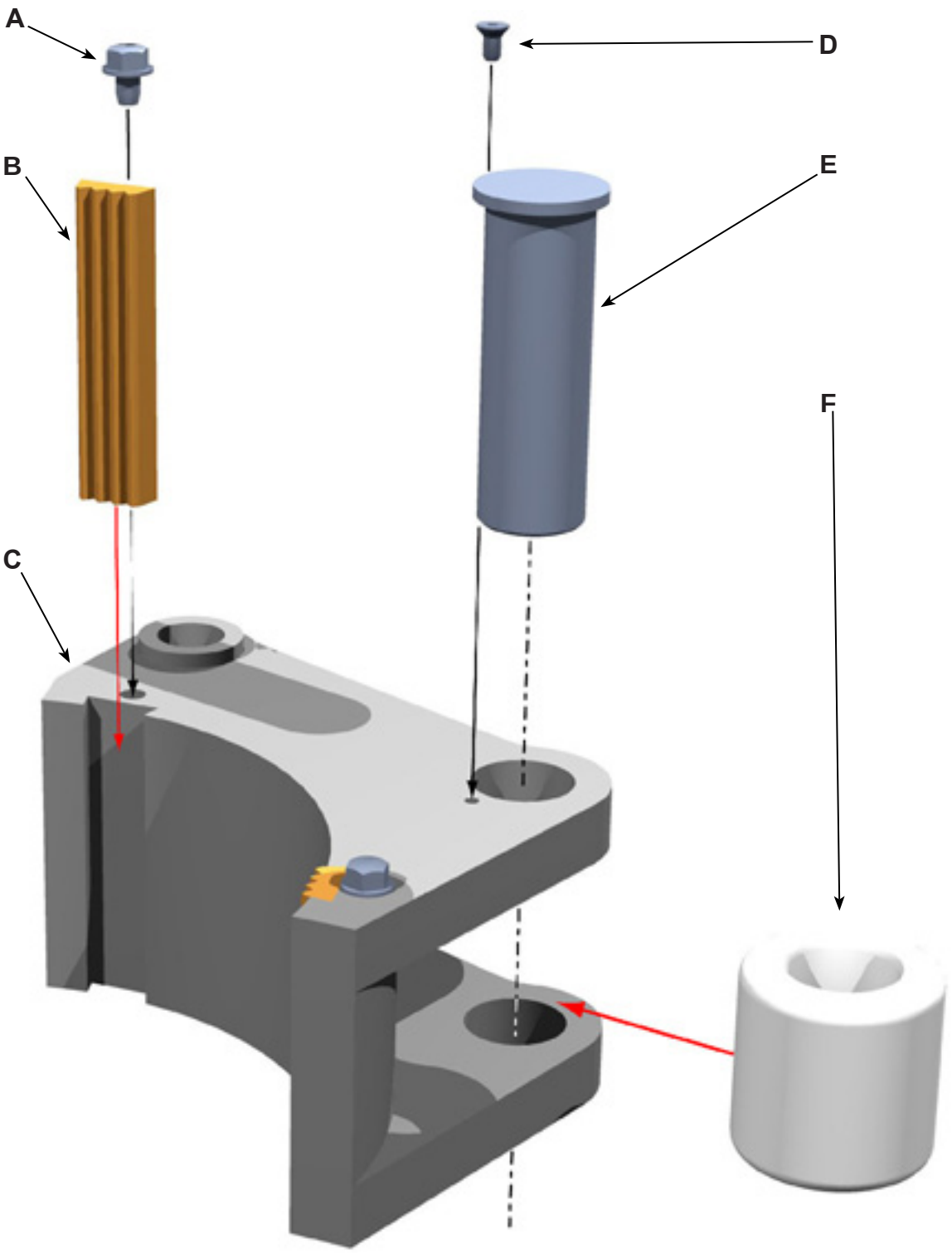

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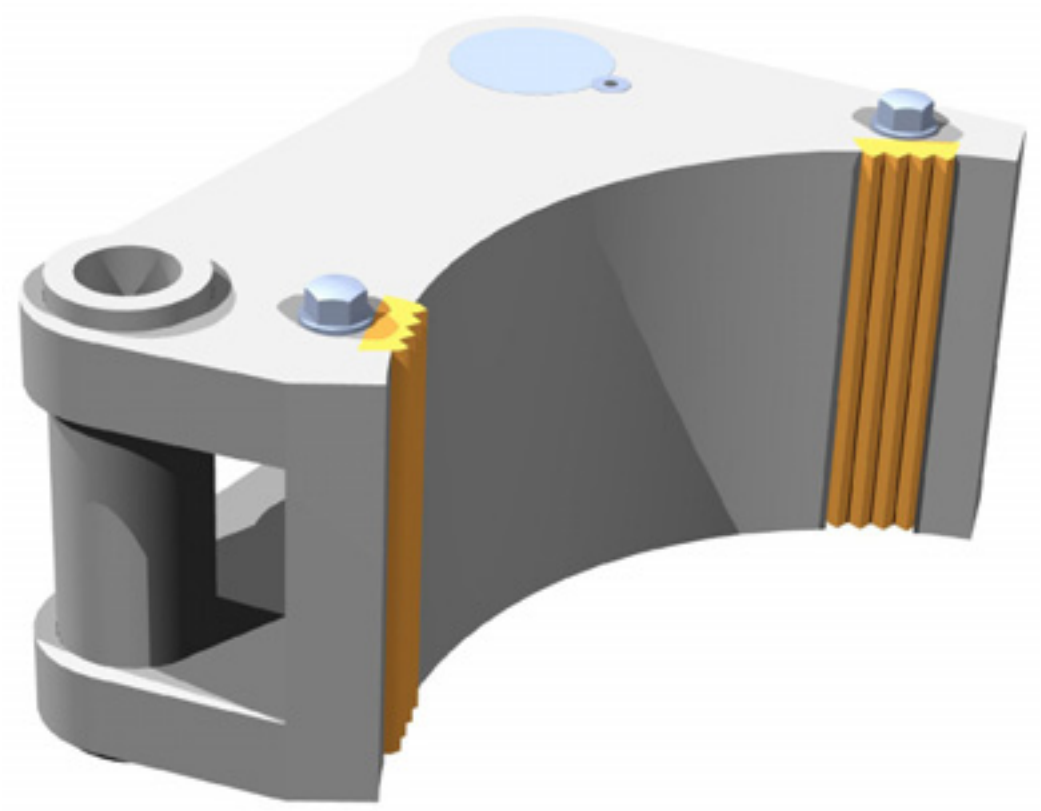
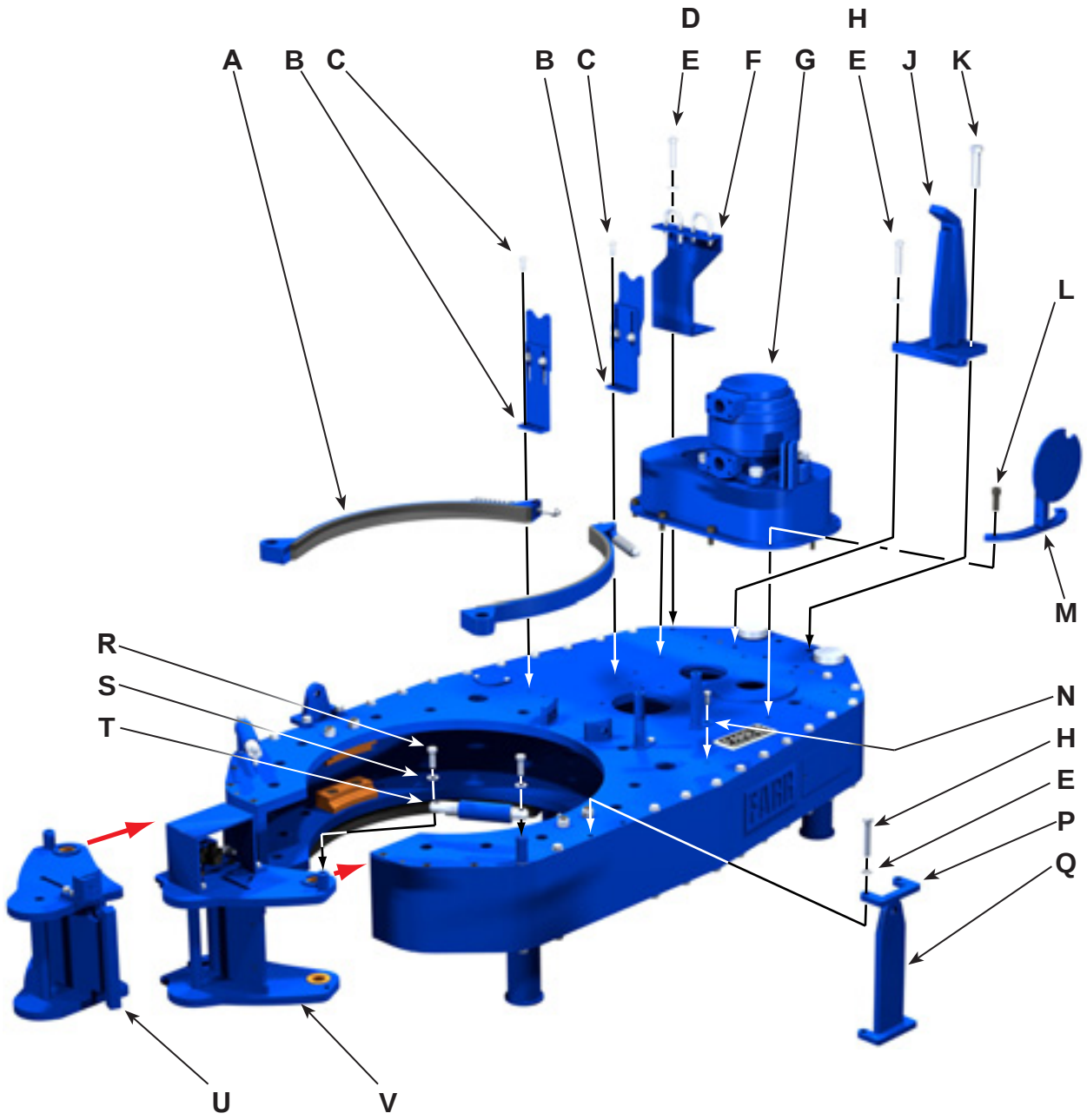


Item	Type	Description	Qty	Part Number
A	Part	3/8” NC x 1/2” Hex Washer Head Machine Screw	2	
B	Part	Standard 5” Die Insert	2	12-1005
C	Part	Jaw Weldment (11 “ Shown)	1	1393-J-11000
NOTE: Other available sizes of jaw weldments carry the part number 1393-J-”SIZE” i.e. an 8-5/8” Jaw Weldment carries the part number 1393-J-8625. (See Pg. 2.12)				
D	Part	1/4” NC x 1/2” Hex Flat Countersunk Cap Screw	1	
E	Part	Jaw Pin	1	1393-JP
F	Part	Jaw Roller	1	1393-JR-300



WHEN RE-ASSEMBLING LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS) NOTE THAT THE ASSOCIATED FASTENERS MUST BE TIGHTENED TO THE CORRECT TORQUE SPECIFIED FOR THAT SIZE OF FASTENER. CHECK ALL CHAINS FOR DAMAGE BEFORE PLACING UNDER LOAD. ENSURE CHAINS ARE NOT KINKED BEFORE PLACING UNDER LOAD.

See Page 3.12

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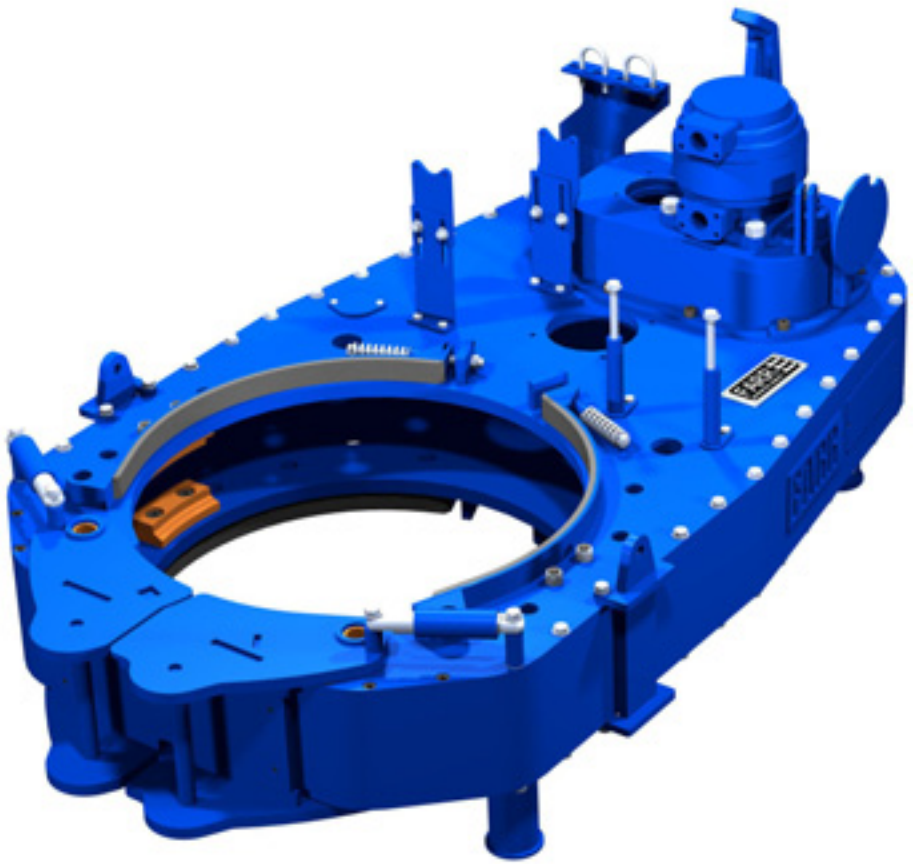
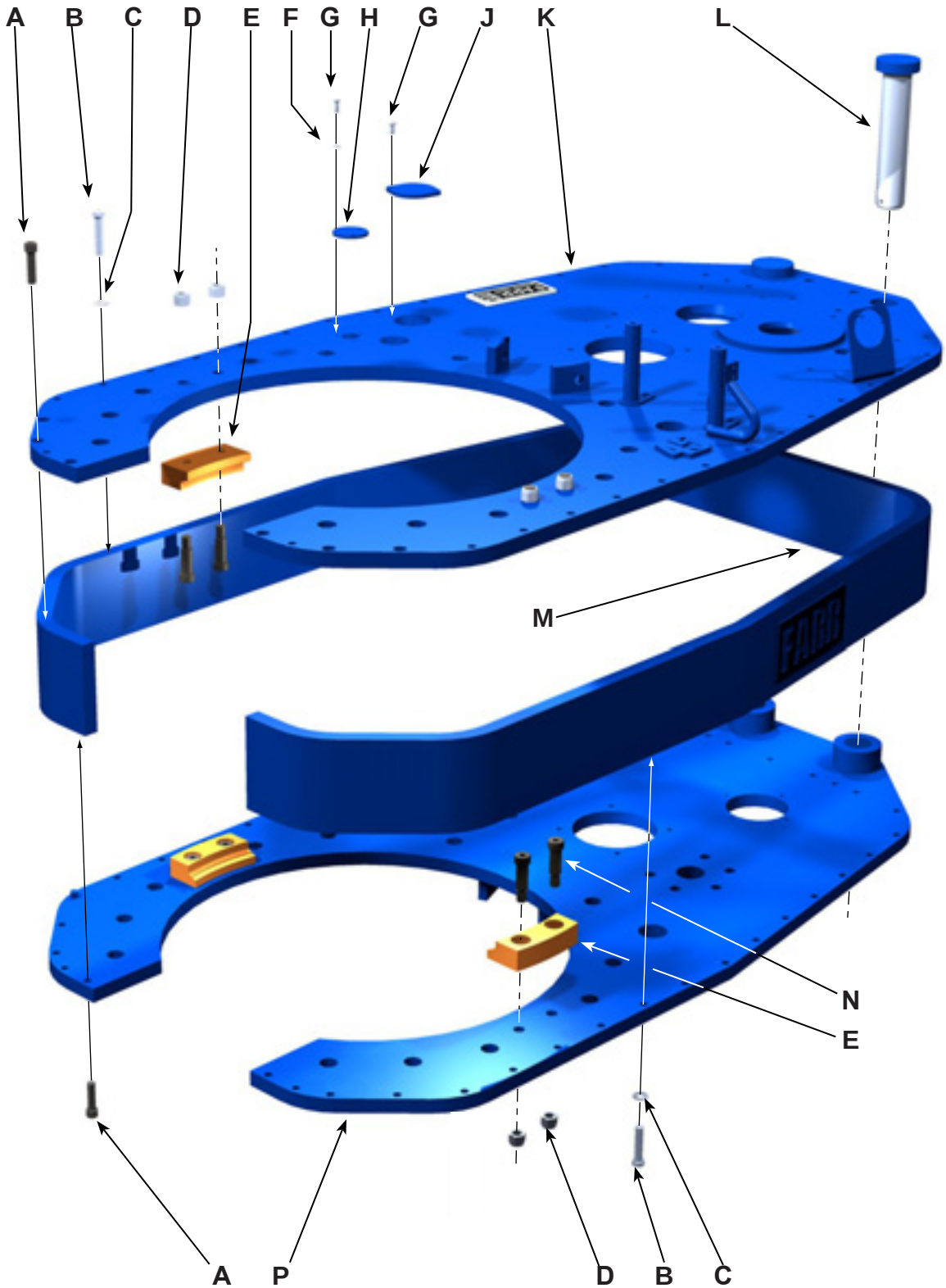


Item	Type	Description	Qty	Part Number
A	Assembly	Brake band Assembly	4	1393-29-05
B	Assembly	Adjustable Hydraulic Support (See Pp. 5.38 - 5.39)	2	
C	Part	3/8” NC x 1” Hex Bolt	6	09-1170
D	Part	1/2” NC x 2-1/2” Hex Bolt	53	09-1176
E	Part	1/2” Carbon Steel Lock washer	64	09-5119
F	Weldment	Hyd. Pipe Mount Weldment (See Pp. 5.38 - 5.39)	1	
G	Assembly	Motor & Motor Mount (See Pp. 5.42 - 5.43)	1	
H	Part	1/2” NC x 3” Hex Bolt	11	09-1176
J	Weldment	Rear Chain Sling Hanger	1	101-0488
K	Part	3/4” NC x 3-1/2” Hex Cap Screw	2	09-1300
	Part	3/4” Lock washer	2	09-5118
	Part	3/4” Nylock Nut	2	1429-39-02
L	Part	1/2” x 1-1/2” Hex SHCS	2	09-2170
M	Assembly	Gauge Holder (See Pp. 5.42 - 5.43)	1	
N	Part	Hydraulic Valve Support (See Pp. 5.38 - 5.39)	2	
P	Part	Hanger Bracket Base	2	101-0361
Q	Weldment	Chain Hanger Weldment	2	1393-A-2B
R	Part	1/2” x 1-1/2” Hex Bolt	2	09-1170
S	Part	1/2” Narrow Washer	2	09-5119
T	Assembly	Door Cylinder	2	1037-A4-144
U	Assembly	RH Door Assembly (See Pp. 5.48 - 5.49)	1	
V	Assembly	LH Door Assembly (See Pp. 5.48 - 5.49)	1	



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Item	Type	Description	Qty	Part Number
A	Part	1/2” NC x 1-1/4” Socket Head Cap Screw	8	09-2168
B	Part	1/2” NC x 2-1/2” Hex Bolt	53	09-1176
C	Part	1/2” Carbon Steel Lock washer	64	09-5119
D	Part	5/8” NC Nylock Nut	8	09-5614
E	Part	Supporting Segment	4	1393-141
F	Part	1/4” Lock washer	3	09-5102
G	Part	1/4” NC x 3/4” Hex Cap Screw	3	09-1005
H	Part	Turn Sensor Cover Plate	1	101-0012
J	Part	Cover Plate	1	101-1246
K	Part	Top Plate	1	101-1760
L	Part	Anchor Pin	2	AX07-003
M	Part	Side Body Weldment	1	101-0154
N	Part	3/4” x 1-3/4” x 5/8” NC Hex Socket Shoulder Bolt	8	1393-141-01
P	Part	Bottom Plate	1	101-0153

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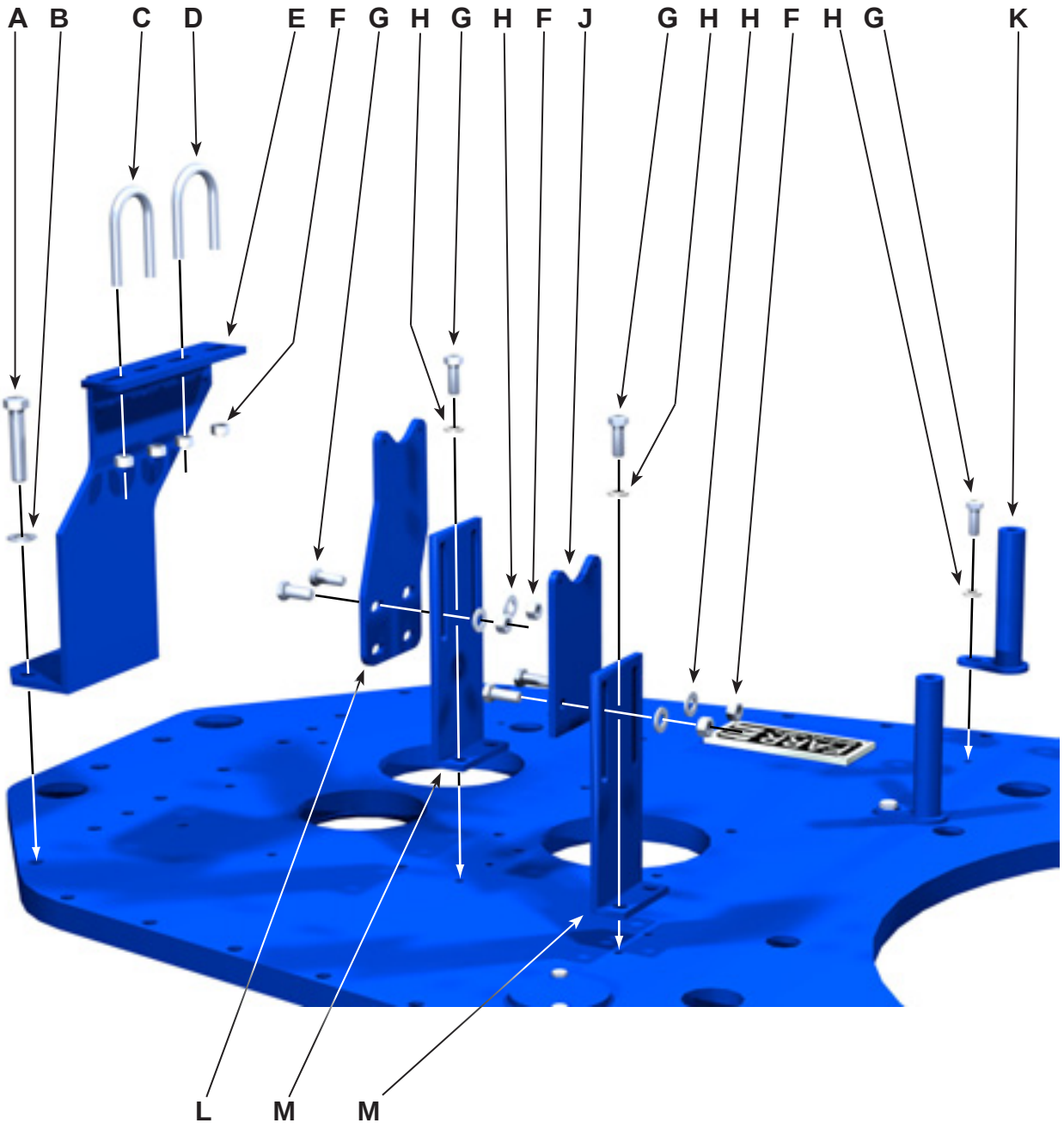

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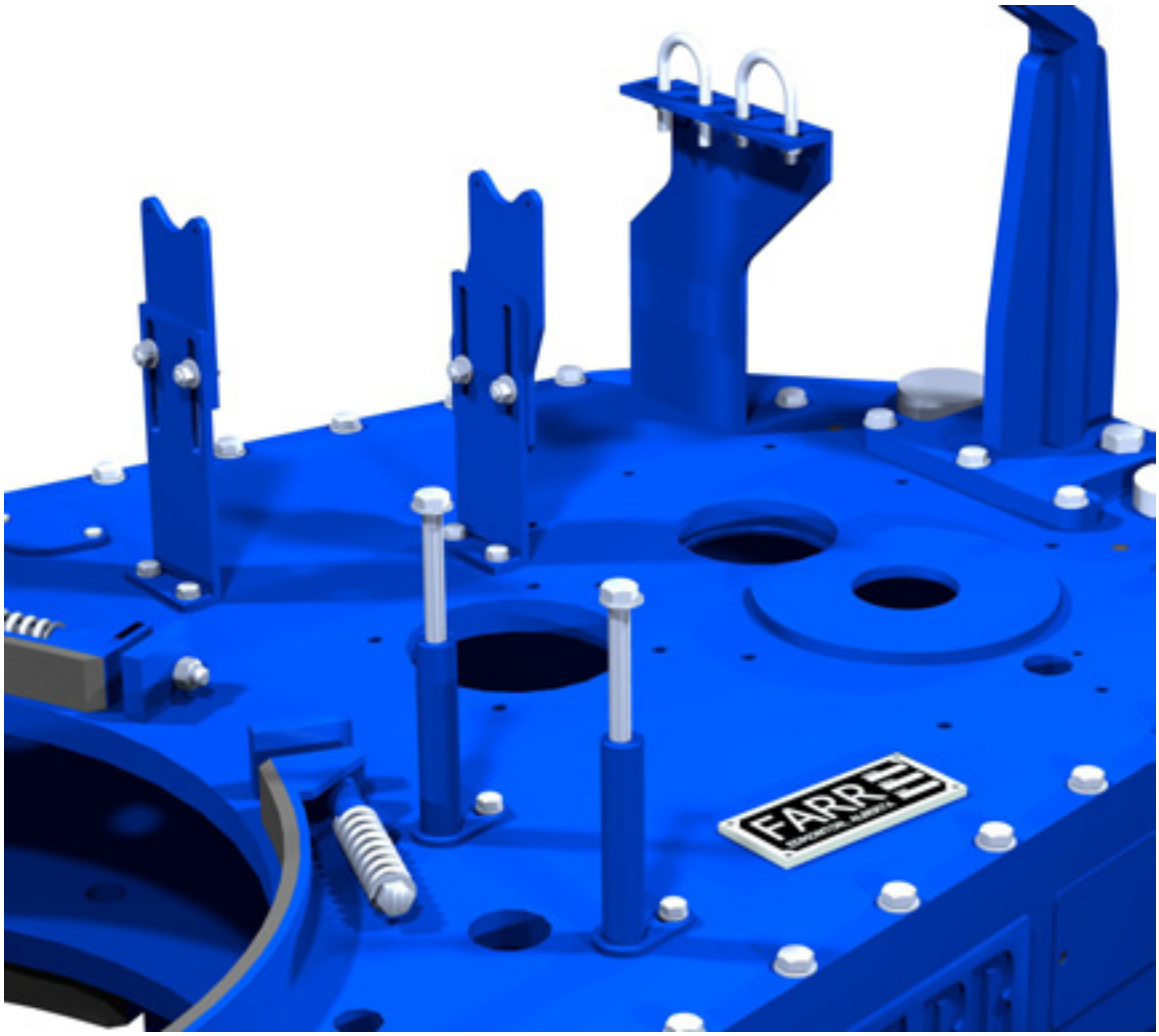

Item	Type	Description	Qty	Part Number
A	Part	1/2” NC x 2-1/2” Hex Bolt	2	09-1176
B	Part	1/2” Carbon Steel Lock washer	12	09-5119
C	Part	3/8” U-Bolt 1-1/2” I.D.	1	101-2075
D	Part	3/8” U-Bolt 1-3/4” I.D.	1	101-2076
E	Weldment	Hydraulic Pipe Mount Weldment	1	101-1806
F	Part	3/8” NC Hex Nut	8	09-5806
G	Part	3/8” NC x 1” Hex Bolt	10	09-1170
H	Part	3/8” carbon Steel Lock washer	10	09-5106
J	Part	Coupling Support Mount Plate	1	101-0022
K	Weldment	Valve Mount Weldment	2	101-1442
L	Part	Coupling Support Mount Plate	1	101-1583
M	Weldment	Hydraulic Coupling Support Weldment	2	101-1138

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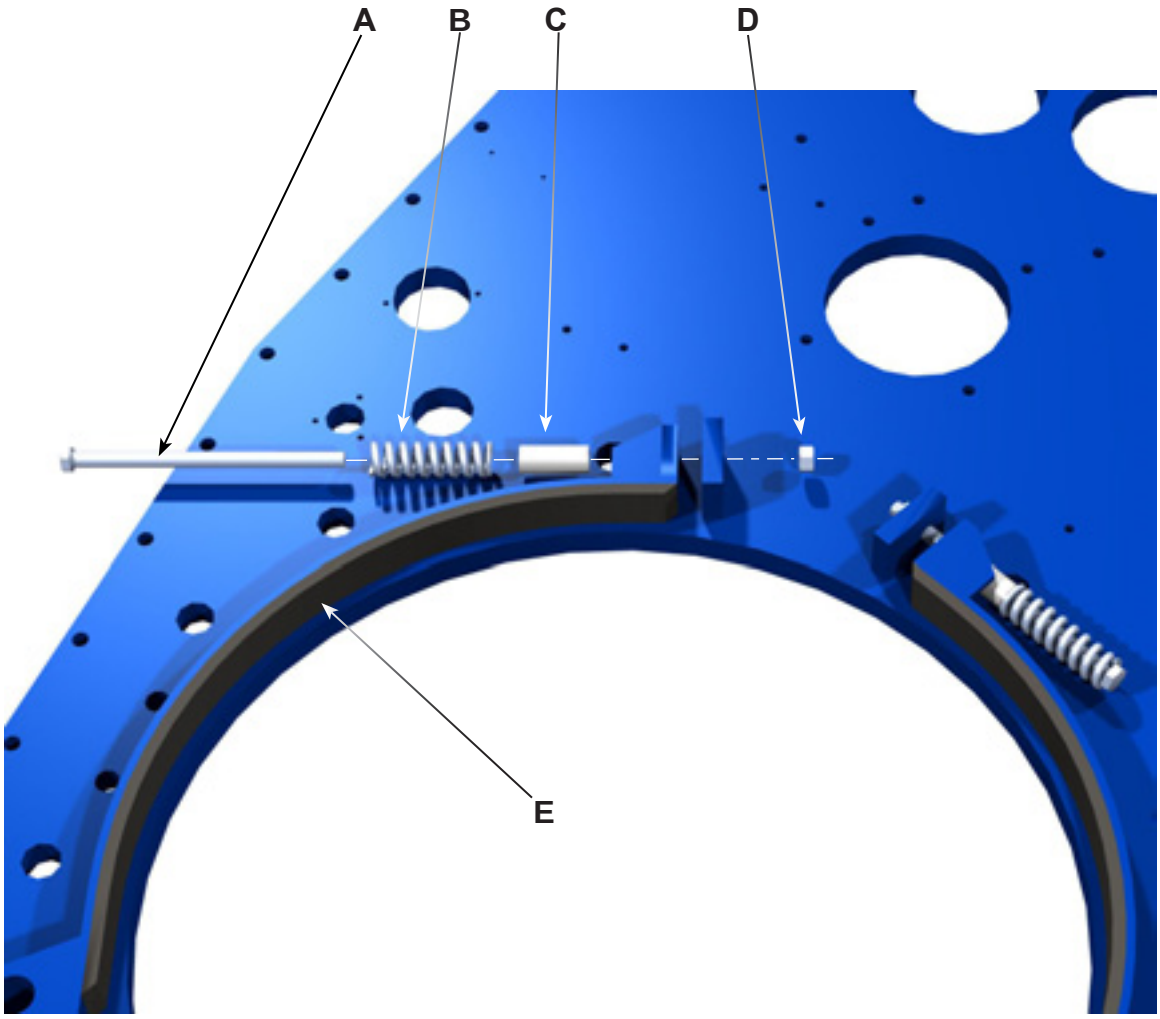

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Item	Type	Description	Qty	Part Number
A	Part	1/2” NC x 8-1/2” Adjustment Bolt	1	09-1200
B	Part	Brake band Spring	1	1404-29-04
C	Part	Brake band Spacer	1	1393-29-04B
D	Part	1/2” NC Hex Nut	1	09-9124
E	Part	Brake band Weldment With Lining	1	1393-29-05

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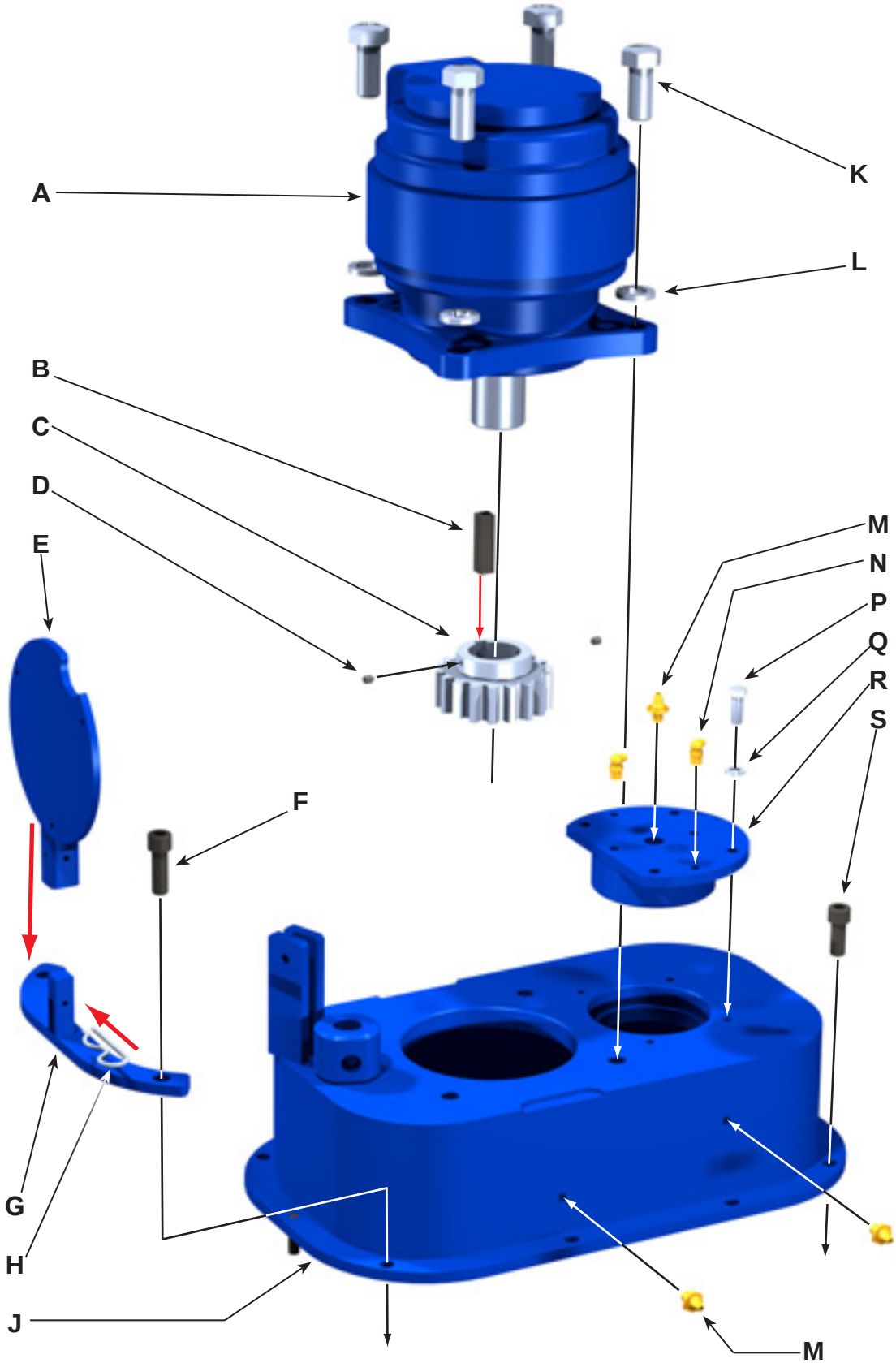

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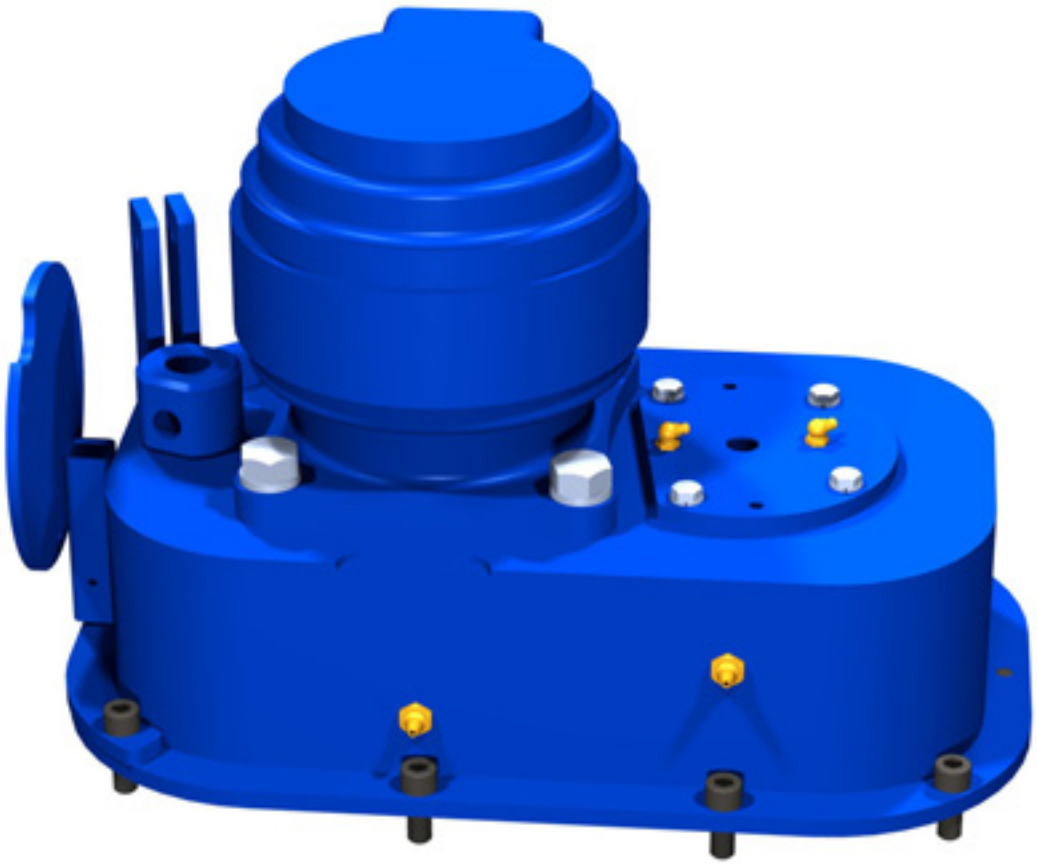

Item	Type	Description	Qty	Part Number
A	Part	Rineer GA37-26 Hydraulic Motor	1	87-0130
B	Part	Square 1/2 x 1/2 x 2 Motor Gear Key	2	
C	Part	Motor Gear	1	1393-149
D	Part	1/4” NC x 3/8” Hex Socket Set Screw	2	09-0107
E	Weldment	Torque Gauge Mount Weldment	1	101-1783
F	Part	1/2” NC x 1-1/2” Hex Socket Head Cap Screw	2	09-2170
G	Weldment	Gauge Mount Weldment	1	101-1621
H	Part	0.148 X 2.938 HITCH PIN	1	09-0090
J	Weldment	Motor Mount Weldment	1	101-1808
K	Part	3/4” NC x 1-3/4” Hex Bolt	4	09-1292
L	Part	3/4” Carbon Steel Lock washer	4	09-5118
M	Part	1/8” NPT Grease Fitting	3	02-0005
N	Part	1/8” NPT x 90 deg Grease Fitting	2	02-0093
P	Part	3/8” NC x 1” Hex Bolt	4	09-1170
Q	Part	3/8” Carbon Steel Lock washer	4	09-5006
R	Part	Lay Gear Bearing Cap	1	1393-151
S	Part	1/2” NC x 1-1/4” Hex Socket Head Cap Screw	6	09-2170

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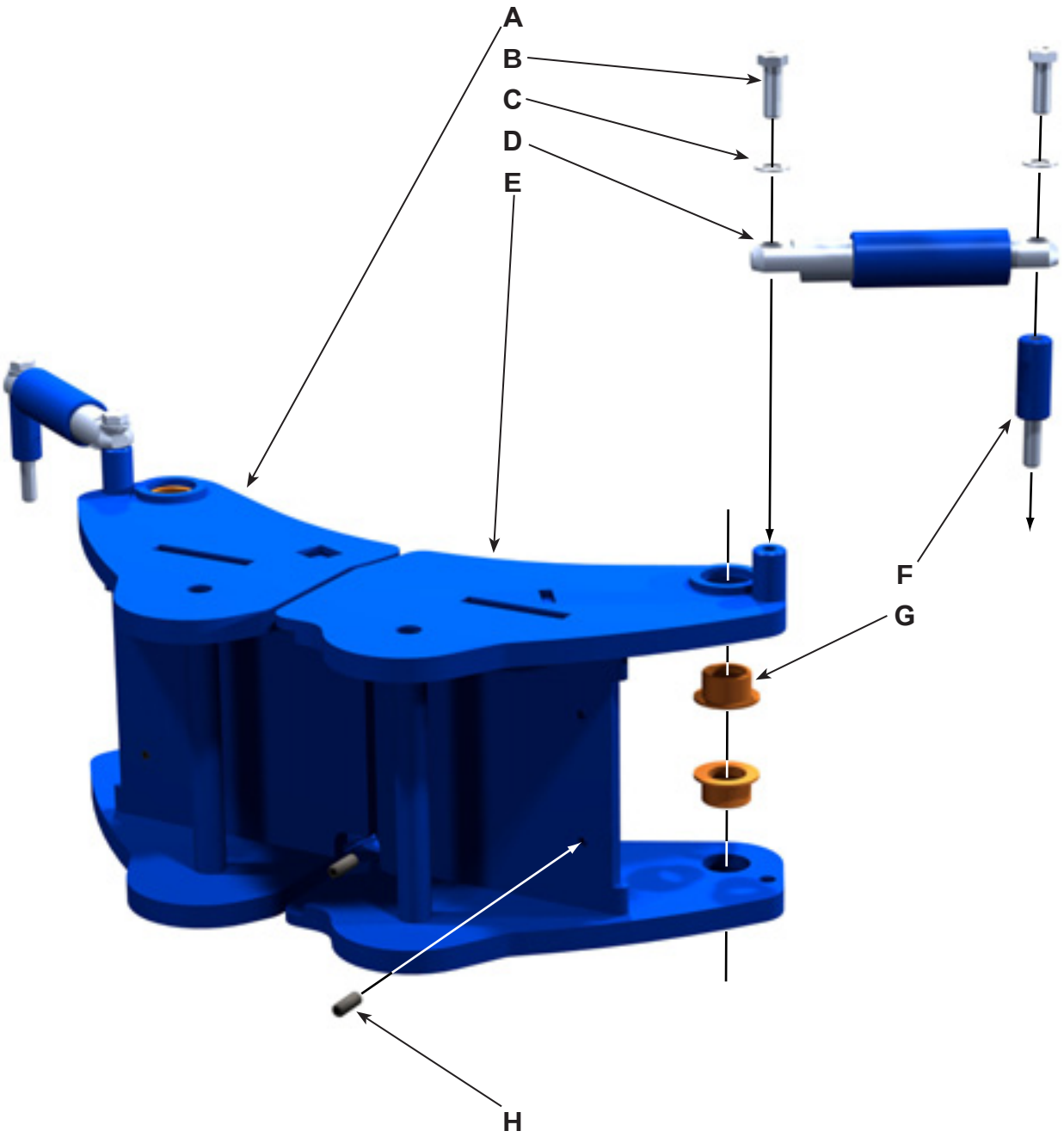

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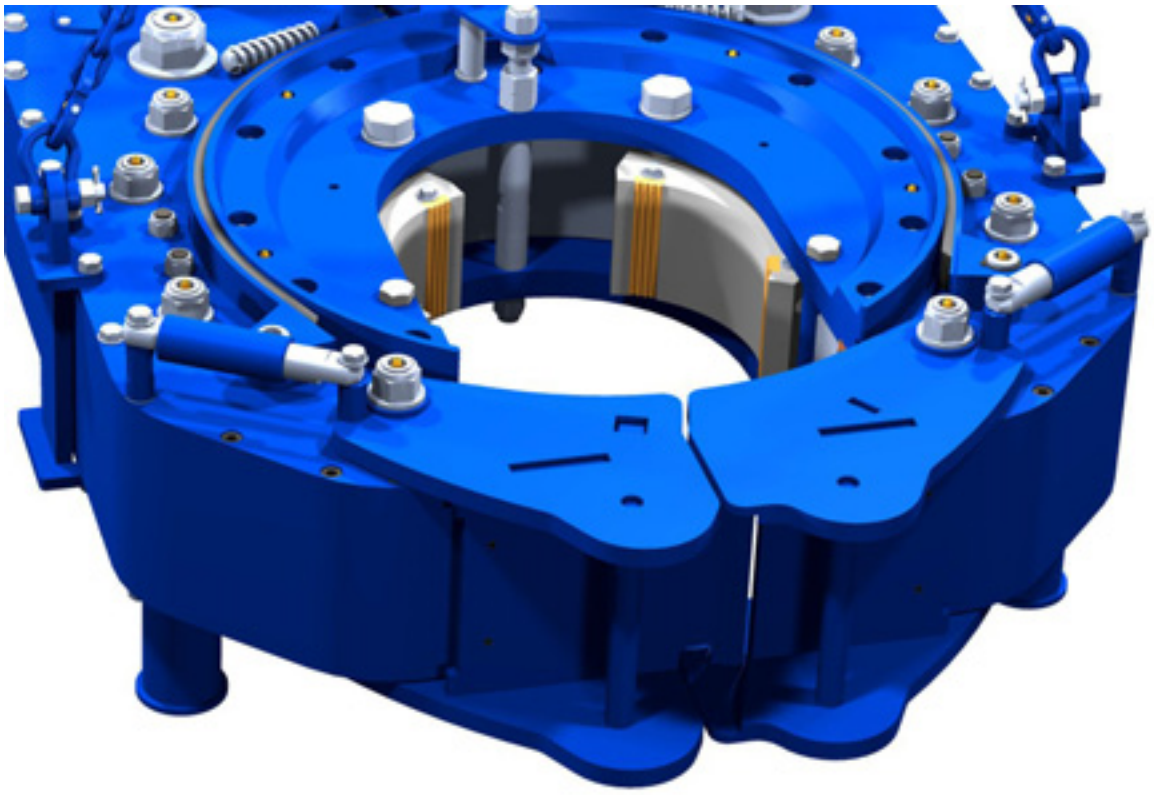

Item	Type	Description	Qty	Part Number
A	Weldment	RH Door Weldment	1	101-1756
B	Part	1/2” NC x 1-1/2” Hex Bolt	4	09-1170
C	Part	1/2” Narrow Washer	4	09-5119
D	Part	Door Cylinder	2	1037-A4-144
E	Weldment	LH Door Weldment	1	101-1754
F	Part	Door Cylinder Mounting Post	1	101-1796
G	Part	Door Bushing	4	101-1795
H	Part	3/8” NC x 1” Set Screw	4	09-1395

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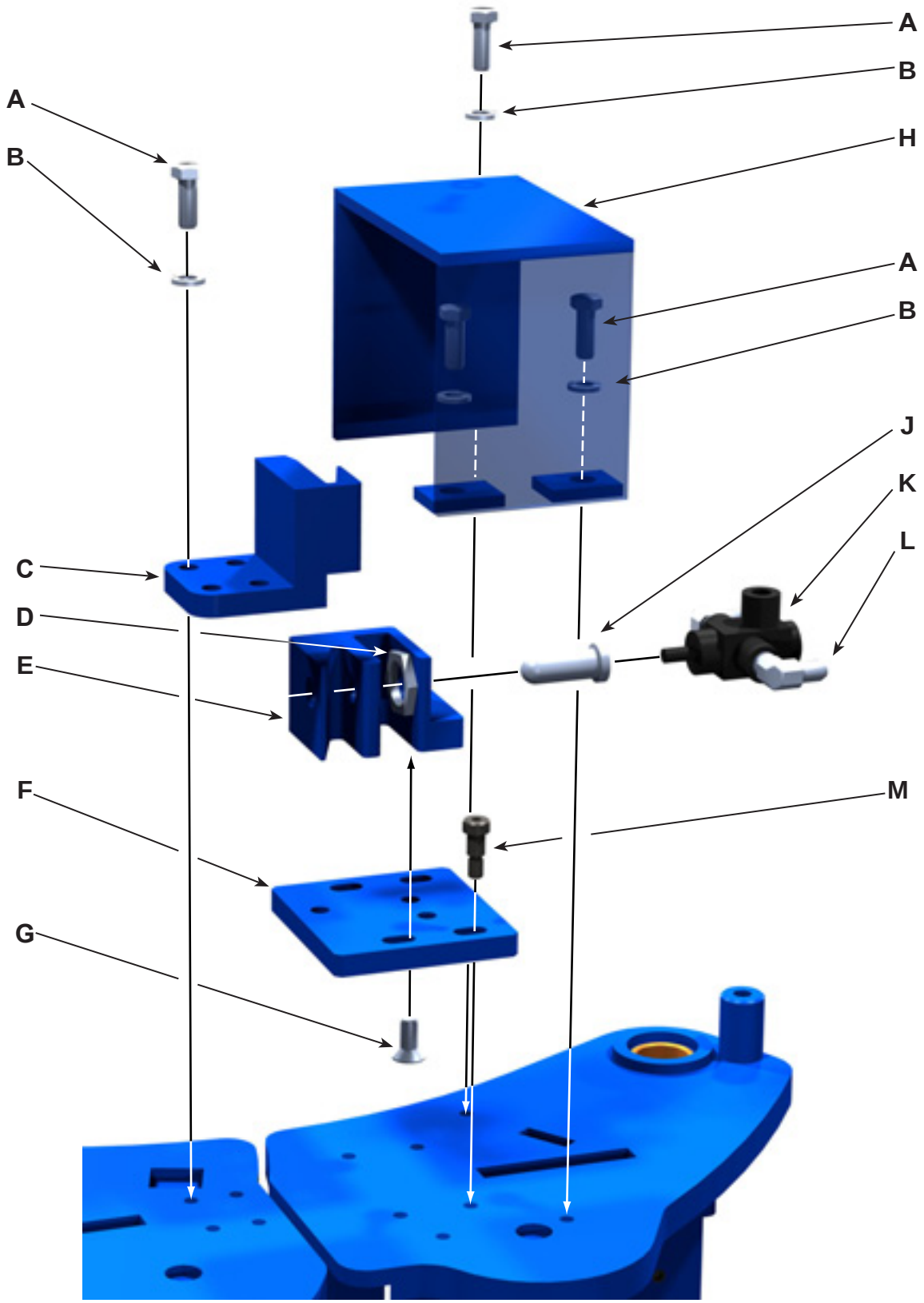

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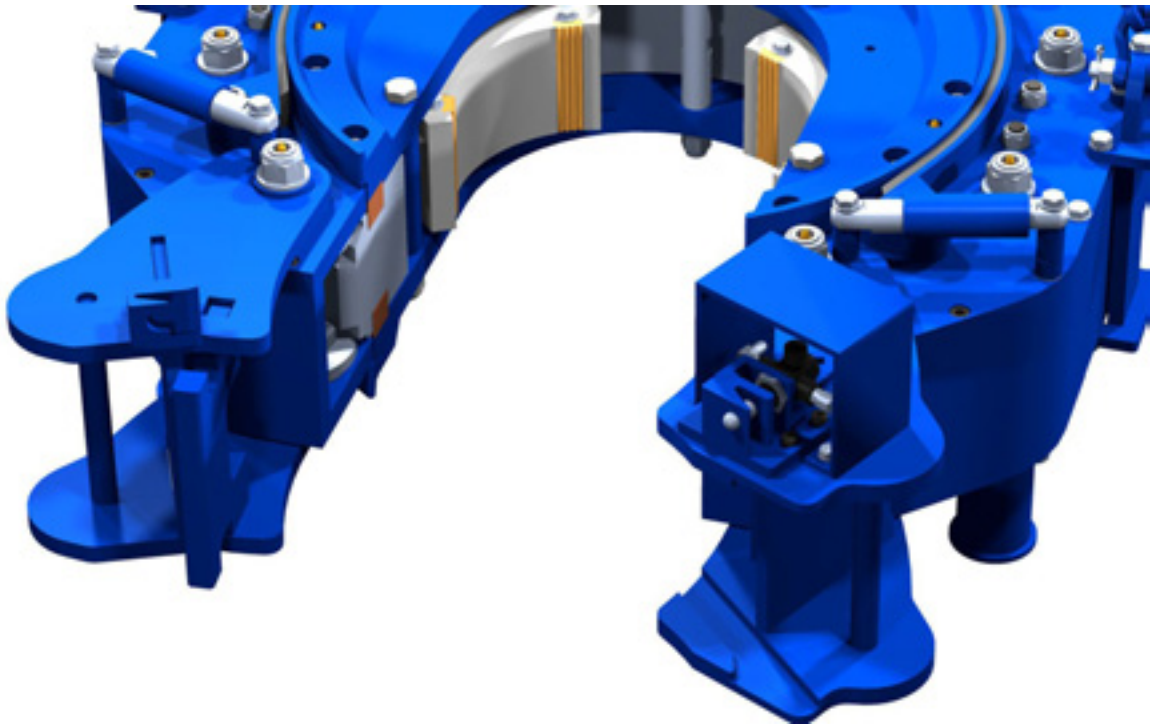
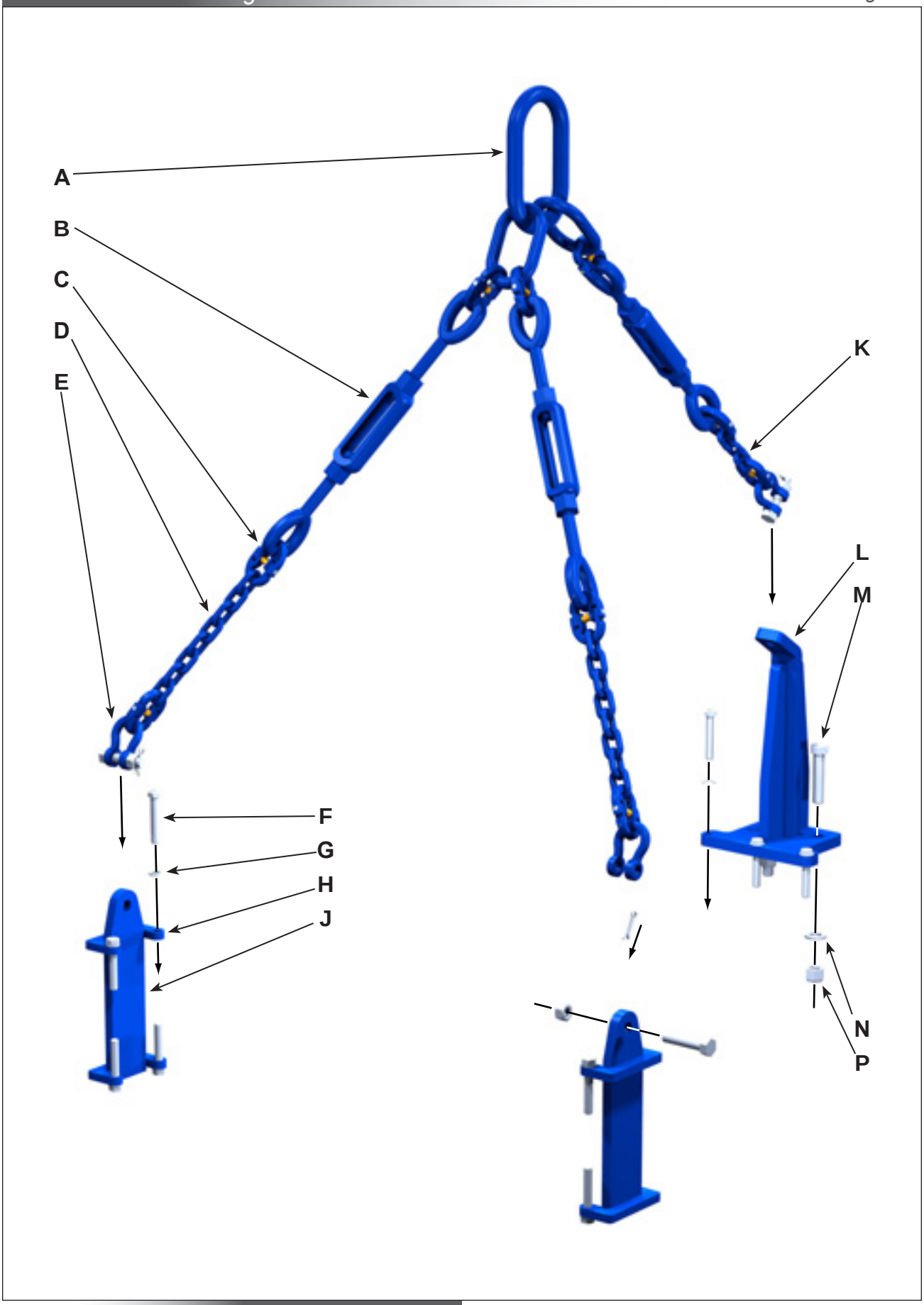


Item	Type	Description	Qty	Part Number
A	Part	3/8” NC x 1” Hex Cap Screw	4	09-1170
B	Part	3/8” Carbon Steel Lock washer	4	09-5106
C	Part	Safety Door Latch Block	1	AE13-302M
D	Part	15/16” Valve Lock Nut	1	09-0278
E	Part	Safety Door Latch Block	1	AE13-301S
F	Part	Door Latch Plate	1	AE13-311
G	Part	3/8” NC x 3/4” Hex Socket FHCS	3	09-4044
H	Weldment	Safety Door Guard	1	101-1614
J	Part	Load Plunger	1	AE12-306
K	Part	Deltrol Gauge Isolator Valve G121S	1	08-0337M
L	Part	1/4 inch NPT - JIC 90 degree elbow 2024-4-4	3	08-0824
M	Part	3/8” x 1/2” Shoulder Bolt	4	09-9179



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Item	Type	Description	Qty	Part Number
	Assembly	Chain Sling		101-1343
A	Part	Master Link	1	02-0517
B	Part	Chain Sling Hammer Lock	9	02-0607
C	Part	Chain Sling Turnbuckle	3	02-6506
D	Part	8-Link Chain	2	101-1344
E	Part	Chain Sling Shackle	3	02-9063
F	Part	1/2” NC x 3” Hex Bolt	11	09-1178
G	Part	1/2” Carbon Steel Lock washer	11	09-5108
H	Part	Hanger Bracket Base	2	101-0361
J	Weldment	Chain Sling Hanger	2	1393-A-2B
K	Part	3-Link Chain	2	101-1345
L	Weldment	Rear Chain Sling Hanger	1	101-0488
M	Part	3/4” NC x 3-1/2” Hex Bolt	2	09-1300
N	Part	3/4” Plain Flat washer	2	09-5018
P	Part	3/4” NC Nylock Nut	2	1429-39-02

WHEN RE-ASSEMBLING LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS) NOTE THAT THE ASSOCIATED FASTENERS MUST BE TIGHTENED TO THE CORRECT TORQUE SPECIFIED FOR THAT SIZE OF FASTENER. CHECK ALL CHAINS FOR DAMAGE BEFORE PLACING UNDER LOAD. ENSURE CHAINS ARE NOT KINKED BEFORE PLACING UNDER LOAD.

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A. BASIC TORQUE MEASUREMENT

Basic torque measurements are performed using a simple hydraulic measurement system. A hydraulic load cell connects to a calibrated torque gauge through a reinforced flexible hydraulic hose. The torque gauge is factory-calibrated to display accurate torque measurements for a tong or tong and backup assembly with a particular arm length. The arm length is a measurement from the centre of the pipe or casing to the centre of the force being applied to the load cell.

Two load cell options are available. A tension load cell is typically used with a suspended stand-alone tong. This application requires that the load cell be attached to the rear of the tong as part of the restraint line that opposes the force generated when the tong makes up or breaks out a joint. A compression load cell is used in a tong and backup assembly, and is typically located on the rear of the backup between the backup and a stationary frame. The load cell must be located in the centre of the compression force vector generated between the backup and the frame.

Hydraulic force generated by a load cell is transmitted to the torque gauge via a reinforced flexible hydraulic line. The hydraulic force is displayed as torque in units of Ft.-Lbs. The torque gauge has a red “peak torque” indicator that tracks with the torque gauge needle to the point of highest torque, and remains at the point of highest torque until manually reset. Note that every model of tong and tong and backup assembly has a unique arm length, and the torque gauge must be calibrated for that arm length. Torque gauges that are not calibrated for the arm length of the tool in service will not display correct torque. To ensure correct torque measurement, ensure the arm length or “handle” as displayed on your torque gauge matches the arm length of the tool in service as listed on the specifications page of the technical manual.

The images on this page are for illustration purposes only and may not accurately represent the torque gauge and load cell that have been supplied with your equipment.

THE IMAGES DISPLAYED ARE SUPPLIED FOR ILLUSTRATION PURPOSES ONLY

Illustration 6.A.1: Torque Gauge (For Illustration Purposes Only)

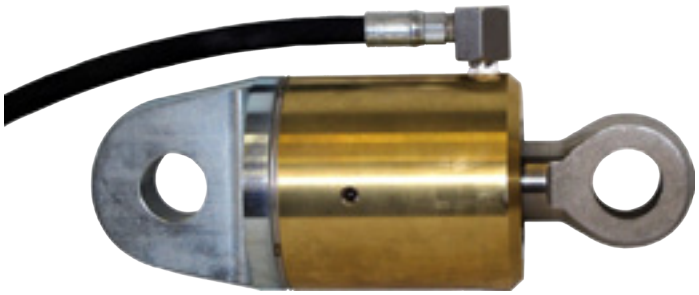

Illustration 6.A.2: Tension Load Cell

Illustration 6.A.3: Compression Load Cell

Torque gauges and load cells are supplied as a matched calibrated pair. Substituting one or the other will render the calibration inaccurate even if the actual model numbers appear to be identical. The serial numbers of matching load cell and torque gauges are clearly identified on the calibration certificate. Should you suspect the accuracy of your torque measurements, or wish to replace either component the pair should be returned to the factory for re-calibration before placing into service.

TORQUE GAUGES AND LOAD CELLS ARE FACTORY-SUPPLIED SUPPLIED AS MATCHED CALIBRATED PAIRS. IF REPLACING EITHER COMPONENT THE LOAD CELL AND TORQUE GAUGE MUST BE RETURNED TO THE FACTORY FOR RE-CALIBRATION BEFORE PLACED INTO SERVICE.

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BASIC TORQUE MEASUREMENT (Continued:)

The images on the preceding page are for illustration purposes only and may not accurately represent the torque gauge and load cell that have been supplied with your equipment. Please note that the parts listed in the following table are correct for accurate torque measurement while using the equipment for which this manual is supplied.

THE TORQUE GAUGE USED IS FULLY DEPENDANT UPON THE ARM LENGTH AND TORQUE RANGE OF THE EQUIPMENT IN USE. THE PART NUMBERS LISTED IN THE FOLLOWING TABLE ARE CORRECT FOR ACCURATELY MEASURING TORQUE USING THE EQUIPMENT FOR WHICH THIS MANUAL IS SUPPLIED.

Item	Type	Description	Qty	Part Number
	Assembly	45-1/2” Arm - 50K Torque Gauge / Compression Load Cell Assembly	1	10-0041T
1	Part	45-1/2” Arm 60,000 Ft.-Lbs.Torque Gauge	1	10-0041G
2	Part	Tension Load Cell	1	10-0008T
3	Part	Hydraulic Hose	1	02-0069
4	Part	Torque Gauge Flange	1	997-D7-5
5	Part	Tension Load Cell Shackle	1	02-0078

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Item	Type	Description	Qty	Part Number
	Assembly	Tension Load Cell, 4.08 in^2	1	10-0008T
A	Part	O-Ring	1	02-0800
B	Part	Load Cell Body	1	LC99-104
C	Part	1/4” NC x 1/2” Binding Head Machine Screw	1	09-0045A
D	Part	Stat-O-Seal	1	02-0307
E	Part	O-Ring	1	02-0350
F	Part	O-Ring	1	08-0596
G	Part	Load Cell Piston	1	LC99-101
H	Part	Load Cell End	1	LC99-003
J	Part	Flange Gasket	1	02-0073
K	Part	Load Cell Rod	1	LC99-002
L	Part	Wiper	1	08-1558
M	Part	3/8” NC x 3/8” Cup Point Hex Set Screw	2	09-0106
Seal Kit		Replacement Seal Kit 4.08 in^2 Tension Load Cell		02-4578

This is the standard tension load cell supplied by McCoy Drilling & Completions | Farr. Contact our sales department for information about optional application-specific tension load cells.

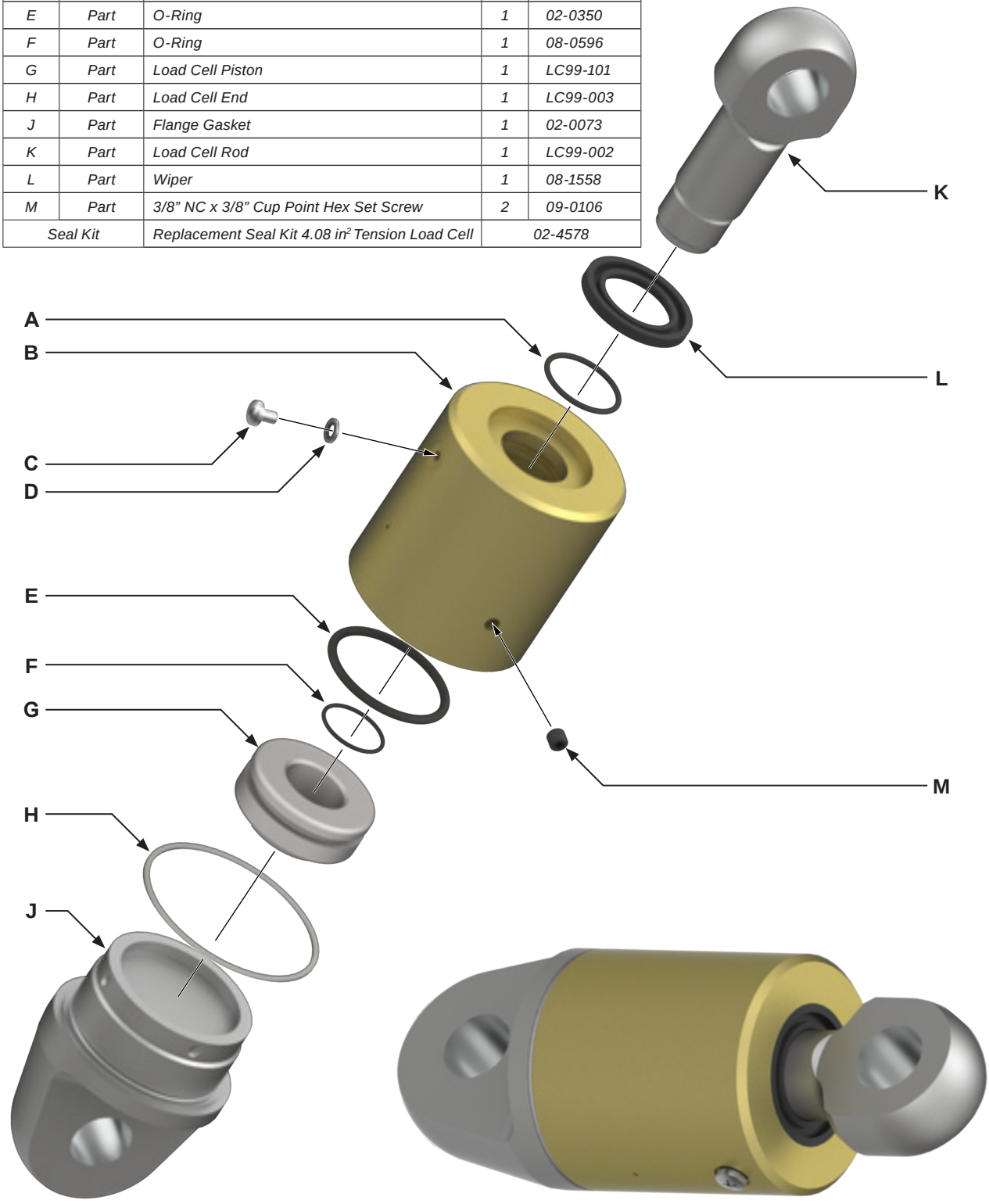

Illustration 6.A.4: Tension Load Cell Exploded

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Item	Type	Description	Qty	Part Number
	Assembly	Compression Load Cell, 8 in^2	1	10-0008C
A	Part	5/16” UNC x 1” Hex Socket Head Cap Screw	1	09-2026
B	Part	Load Plate	1	E360-A
C	Part	5/16” UNC x 3/4” Hex Socket Head Cap Screw	6	09-2024
D	Part	Retainer Ring	1	E360-8
E	Part	Diaphragm	1	E358-2
F	Part	Diaphragm Casing	1	E360-C
G	Part	Street Elbow	1	
H	Part	1/4” NPT Brass Plug	1	

This is the standard hydraulic compression load cell supplied by McCoy Drilling & Completions | Farr. Contact our sales department for information about optional application-specific compression load cells.

Electronic compression load cells are used for some WinCatt™ applications.

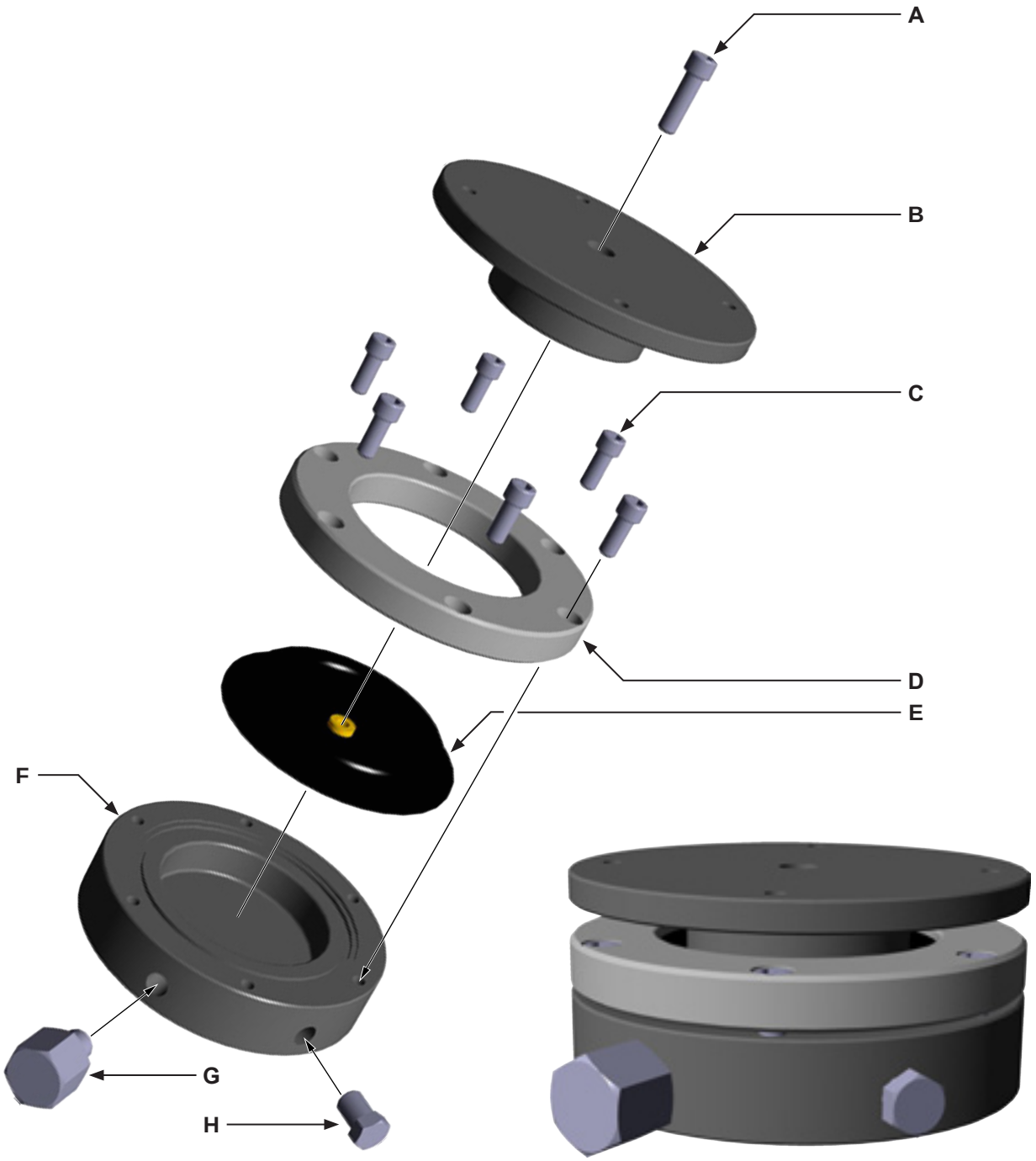

Illustration 6.A.5: Compression Load Cell Exploded

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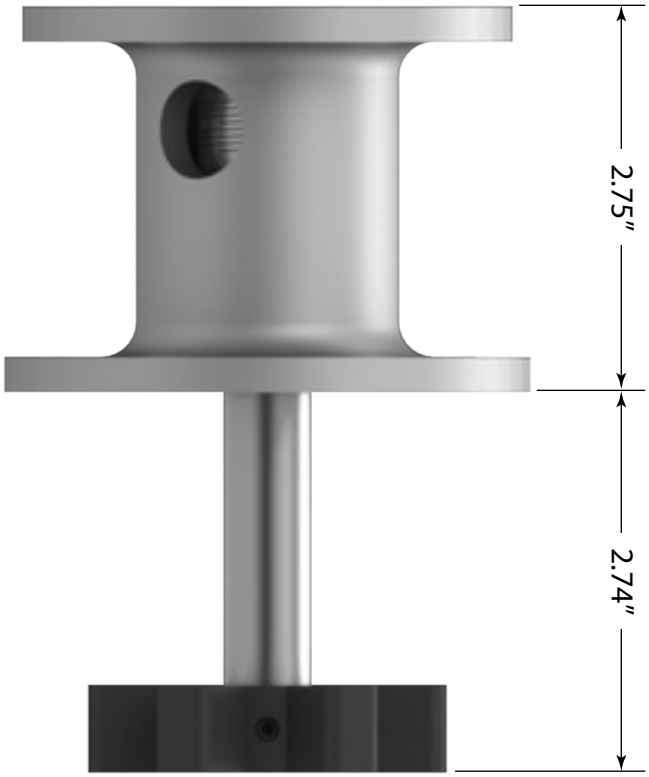

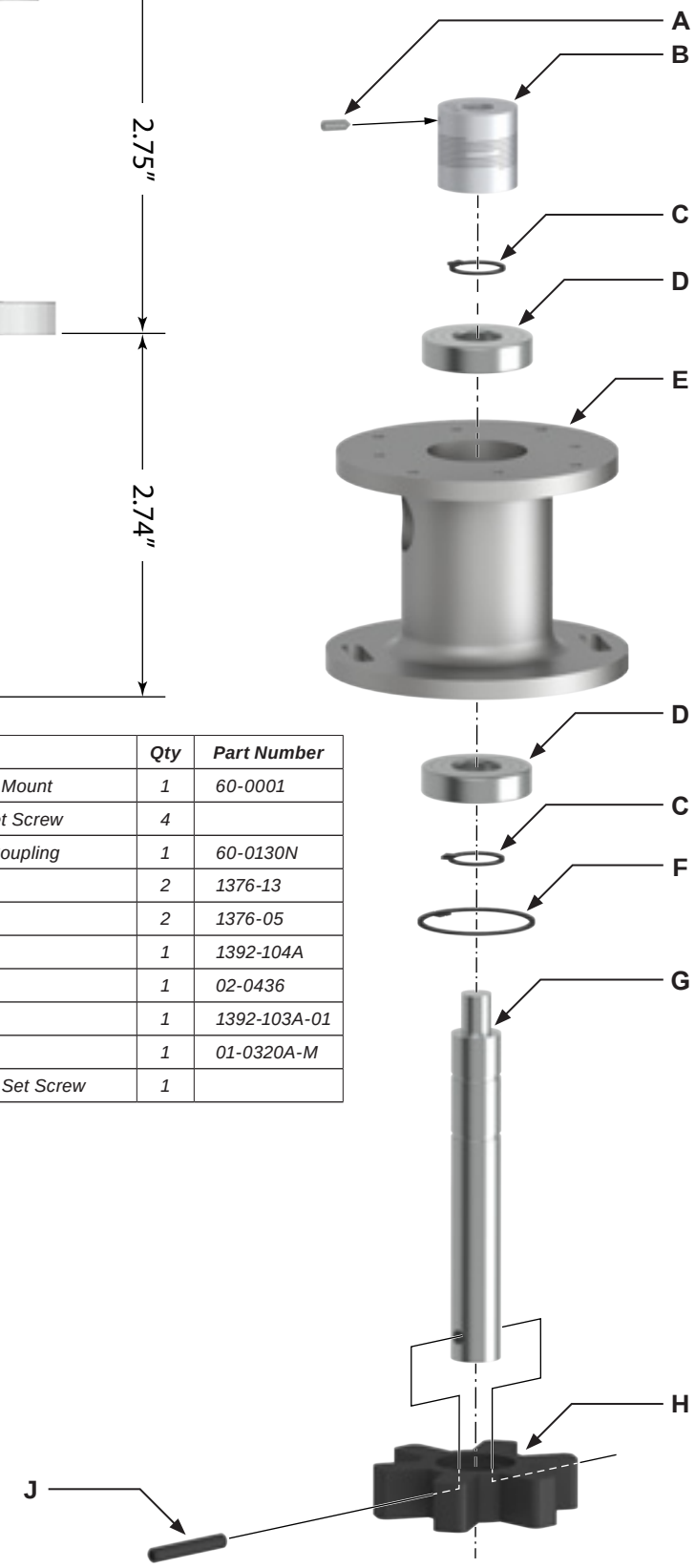

Item	Type	Description	Qty	Part Number
	Assembly	Standard Turn Counter Encoder Mount	1	60-0001
A	Part	6-32 x 3/8” Hex Socket Head Set Screw	4	
B	Part	Helical Flexible Encoder Shaft Coupling	1	60-0130N
C	Part	Internal Retainer Ring	2	1376-13
D	Part	Bearing	2	1376-05
E	Part	Encoder Housing	1	1392-104A
F	Part	Internal Retainer Ring	1	02-0436
G	Part	Encoder Shaft	1	1392-103A-01
H	Part	Encoder Gear	1	01-0320A-M
J	Part	10-24 x 1-1/4” Hex Socket Head Set Screw	1	

Illustration 6.A.6: Turn Counter Encoder Mount Exploded

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B. TROUBLESHOOTING

Under normal operating conditions, and with proper maintenance, the torque gauge and load cell system are designed to give lasting trouble-free performance. Faulty indication on the gauge will very often define a fault within the gauge.

IF TROUBLESHOOTING REVEALS THAT THERE IS INSUFFICIENT FLUID IN THE SYSTEM, BEFORE RECHARGING, CHECK THAT ALL SYSTEM COMPONENTS ARE FREE FROM DAMAGE. THIS WILL ENSURE THAT FLUID LOSS WILL NOT CONTINUE AFTER RELOADING

1. Symptom: No indication on gauge.

Possible Problem: Obstruction in hydraulic hose.
Solutions: Check hydraulic hose for kinks.
Replace hydraulic hose.

Possible Problem: Loss of hydraulic fluid.
Solution: Recharge hydraulic fluid (see Section 6.C). NOTE: Ensure any breaches in the hydraulic system between the load cell and torque gauge are repaired to prevent further fluid loss.

Possible Problem: Internal mechanism of torque gauge is damaged.
Solution: Replace gauge.

2. Symptom: Gauge indication unexpectedly high.

Possible Problem: Excessive hydraulic fluid.
Solutions: Completely drain hydraulic fluid from torque gauge/load cell system. Recharge following the procedure in Section 6.C.

Possible Problem: Internal mechanism of gauge is damaged.
Solution: Replace gauge.

Possible Problem: Incorrect torque gauge in use (not part of the original torque gauge/load cell pair).
Solution: Replace gauge with gauge properly calibrated for the load cell in service.

3. Symptom: Gauge indication unexpectedly low

Possible Problem: Insufficient hydraulic fluid.
Solution: Recharge hydraulic fluid (see Section 6.C). NOTE: Ensure any breaches in the hydraulic system between the load cell and torque gauge are repaired to prevent further fluid loss.

Possible Problem: Obstruction in hydraulic hose.
Solutions: Check hydraulic hose for kinks.
Replace hydraulic hose.

Possible Problem: Snub line not at right-angle to tong handle.
Solution: Check angle of snub line and correct if necessary.

Possible Problem: Internal mechanism of gauge is damaged.
Solution: Replace gauge.

Possible Problem: Incorrect torque gauge in use (not part of the original torque gauge/load cell pair).
Solution: Replace gauge with gauge properly calibrated for the load cell in service.

4. Symptom: Gauge indication is erratic or sluggish

Possible Problem: Insufficient hydraulic fluid in torque measurement section.
Solution: Recharge hydraulic fluid (see Section 6.C). NOTE: Ensure any breaches in the hydraulic system between the load cell and torque gauge are repaired to prevent further fluid loss.

Possible Problem: Loss of damping fluid in torque gauge.
Solution: Top up or refill damping fluid (NOTE: Ensure leakage points in gauge are identified and repaired to prevent further loss of damping fluid).

Possible Problem: Air bubbles in hydraulic fluid in the torque measurement system.
Solution: Bleed air from load cell and torque gauge and top up fluid (if necessary) as per Section 6.C.

Possible Problem: Internal mechanism of gauge is damaged.
Solution: Replace gauge.

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C. PERIODIC INSPECTION AND MAINTENANCE

1. Inspection

The torque measurement system supplied with your equipment is designed and built to provide years of trouble-free service with minimum maintenance. Periodic inspections of the load cell, hydraulic lines and fittings are recommended in order to keep the system in top operating condition. A thorough inspection should be made at each rig-up.

2. Fluid Recharge

Recharge hydraulic system with W15/16 fluid through the check valve on the torque indicating gauge. Recharging must only be performed when there is no load on the load cell. Refer to the illustrations on pages 6.3 & 6.4 for guidance if required.

a. *Place the torque indicating gauge higher than the load cell. Remove the brass 1/4” cap from the fitting on the check valve on the top of the gauge.*

b. *Connect the hand pump to the check valve fitting.*

c. *Elevate the load cell so it is higher than the torque gauge and hand pump.*

UN-CONTAINED SPILLAGE OF THE HYDRAULIC FLUID IN THIS SYSTEM MAY CONTRAVENE GOVERNMENTAL ENVIRONMENTAL REGULATIONS, OR THE ENVIRONMENTAL REGULATIONS AND POLICIES OF YOUR COMPANY. FARR CANADA CORP. HIGHLY RECOMMENDS PLACING YOUR LOAD CELL IN A CONTAINMENT BASIN BEFORE PROCEEDING WITH THE BLEEDING & REFILLING PROCESS.

d. *Fill hand pump bowl with W15/16 hydraulic fluid.*

MAINTAIN GREATER-THAN HALF FULL FLUID LEVEL IN THE HAND PUMP BOWL TO AVOID PUMPING AIR INTO THE SYSTEM. DO NOT ALLOW THE LEVEL TO FALL BELOW ONE-HALF FULL

e. *Remove the vent plug screw and Stat-O-Seal (Items C and D on Illustration 6.A.4, or item H on Illustration 6.A.5) to allow trapped air to escape.*

f. *Pump fluid into the system until no more air is seen escaping from the vent port.*

g. *Replace the vent plug screw and Stat-O-Seal and tighten securely.*

h. *Remove load cell from containment vessel and wipe clean. Reclaim the hydraulic fluid (if it is clean) or dispose of all waste materials according to governmental or your company’s proscribed environmental protection regulations.*

i. *Disconnect the hand pump from the torque gauge.*

j. *Replace the brass cap on the torque gauge check valve fitting.*

3. Repair And Calibration

Load cell and indicator gauge should be returned to authorized repair facility for any repairs or calibration required.

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MANUFACTURER OF HYDRAULIC MOTORS
RINEER HYDRAULICS, INC.

37 series

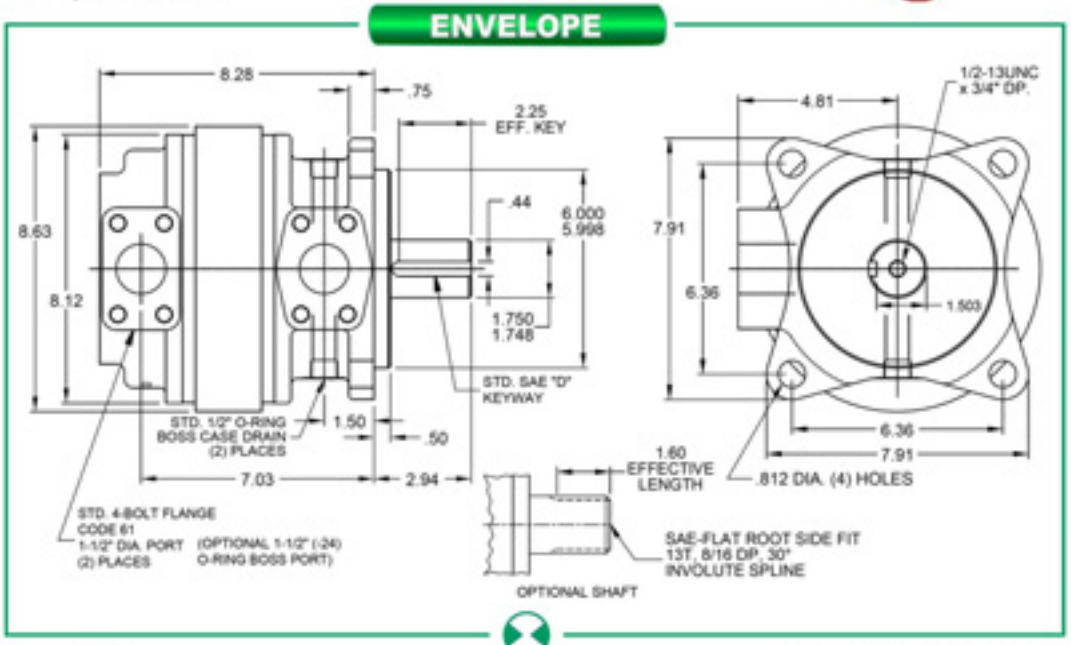
POWER to be the Best!

MOTOR SELECTION GUIDE

Features of the 37 Series Standard Motor: Standard Motor - 3000 PSI (Code 61)

- Six fixed displacement motors ranging from 12 in³ to 37 in³.
- 4-Port double motors from 24 in³ to 74 in³ allowing for two-speed operation with external valving.
- Starting and stall torques equal to 90-94% of theoretical torque.
- Speed to 1,000 RPM continuous.
- Up to 175 HP continuous.
- Conforms to SAE 'D' mounting specification.
- Weighs 106 lbs.

ENVELOPE



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PUBLICATION DS371005 3/04

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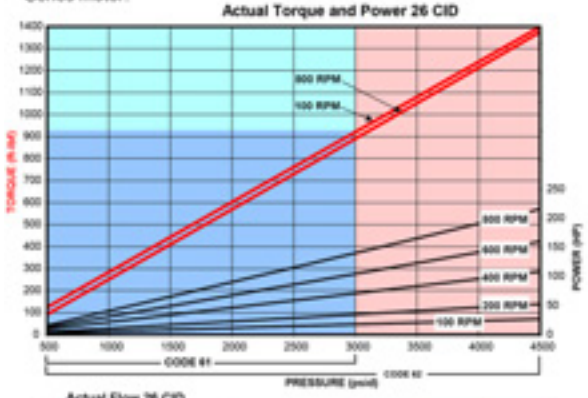
Performance Data

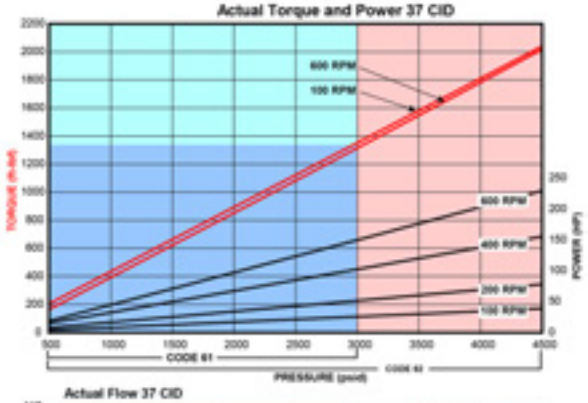
Charts shown are for 26 and 37 CID. See website at www.rineer.com for additional charts. Performance data obtained at 140°F with ISO 46 (DTE 25). Code 61 and 62 data shown. Code 62 extended data applies only to Code 62 High Pressure Series motor.

VANE CROSSING VANE - With it's vane crossing vane design, the Rineer motor produces much higher volumetric and mechanical efficiencies than is possible with a standard vane type design. This design provides a sealing vane between stator cavities to improve mechanical and volumetric efficiencies.

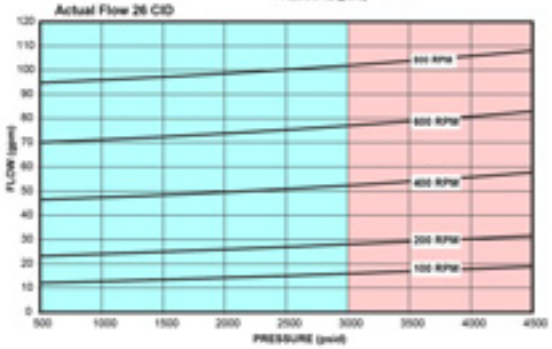
Actual Torque and Power 26 CID



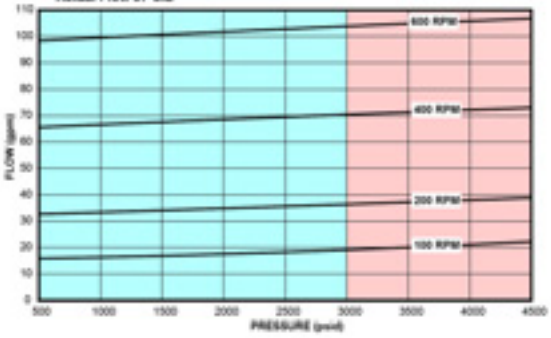
Actual Torque and Power 37 CID



Actual Flow 26 CID

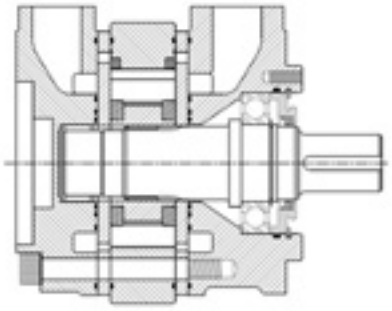


Actual Flow 37 CID



Performance of the Rineer 37 Series Motor has been greatly enhanced by internal design changes resulting in a pressure balanced rotating group. Benefits of this new design include reduced cross port leakage and increased efficiency as well as greater reliability at higher pressures. This patented design has been in effect for over 5 years.

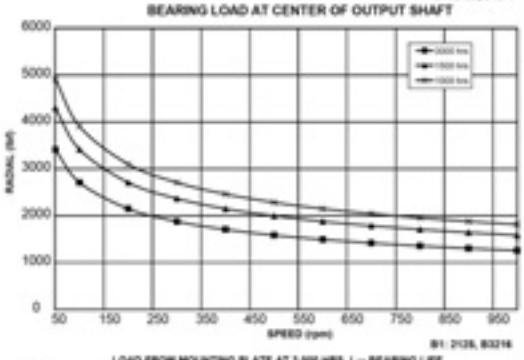
Bearing Data - Standard Motor



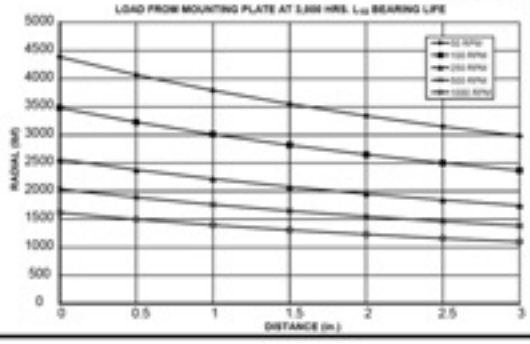
BEARING LOADING - The bearings in the 37 Series can accept radial load per the radial capacity charts to the right. Thrust loading is not recommended for the standard motor. For thrust-type applications, see the thrust capable motor bearing chart on the opposite page.

HORSEPOWER LIMITATION - Maximum horsepower limitation may vary with different applications. When using the 37 Series standard motor above 175HP, consult a Rineer Application Engineer.

BEARING LOAD AT CENTER OF OUTPUT SHAFT



LOAD FROM MOUNTING PLATE AT 3,000 HRS. L_{10} BEARING LIFE



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Envelope - Double Key

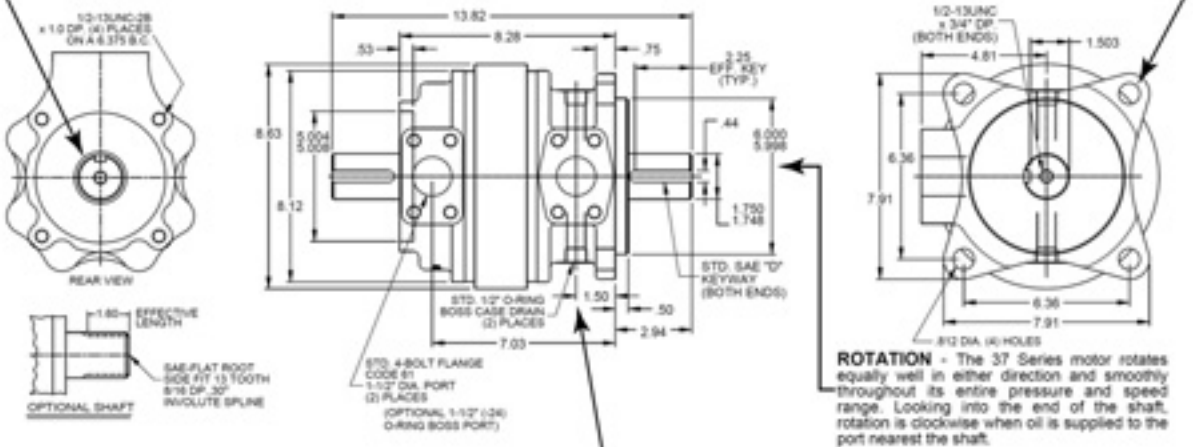
STARTING AND STALL TORQUE
The Rineer motor produces torque curves which are virtually flat, with starting and stall torque equal to approximately 90-94% of theoretical torque.

MORE POWER STROKES PER REVOLUTION
The 37 Series has four stator cavities and 10 rotor vanes. Each rotor vane works in each stator cavity once per revolution, which results in 40 power strokes per revolution. This helps produce higher mechanical efficiency and flatter torque curves.

SEALS - Viton shaft seals are supplied standard. Buna N static seals are supplied standard. Viton static seals may be ordered as an option.

CASE DRAIN AND CROSS PORT LEAKAGE
The combined case drain and cross port leakage of the 37 Series motor is approximately 1 GPM per 1,000 PSI. This will vary with the oil viscosity and internal clearance selection.

SAE 'D' MOUNTING - The 37 Series mounting configuration conforms to SAE 'D' 4-bolt specification, with the exception of the omission of the undercut on the splined shaft.
The mounting position is unrestricted. The shafts, pilots, and mounting faces should be within .002 TIR.



ROTATION - The 37 Series motor rotates equally well in either direction and smoothly throughout its entire pressure and speed range. Looking into the end of the shaft, rotation is clockwise when oil is supplied to the port nearest the shaft.

FLUID - We suggest premium grade fluids containing high quality rust, oxidation and foam inhibitors, along with anti-wear additives. For best performance, minimum viscosity should be maintained at 100 SSU or higher. Fluid temperature should not exceed 180°F. Elevated fluid temperature will adversely affect seal life while accelerating oxidation and fluid breakdown. Fire resistant fluids may be used with certain limitations. Contact Rineer for additional information.

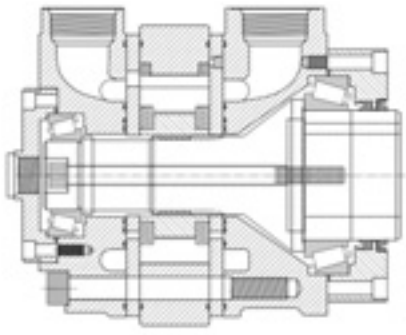
FILTRATION - 25 micron minimum.

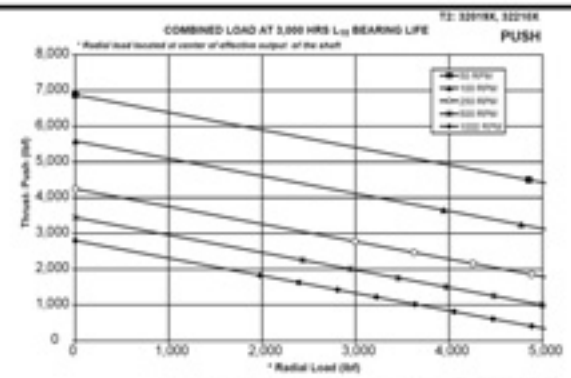
CASE DRAIN - The 37 Series motor requires an external case drain. Two case drain ports are supplied; use the port at the highest elevation. We recommend case pressure of less than 35 PSI.
CASE DRAIN CIRCULATION - Fluid should be circulated through the two case drain ports when a temperature differential exists between the motor and the system in excess of 50°F. ***Should this occur, contact a Rineer Application Engineer.***

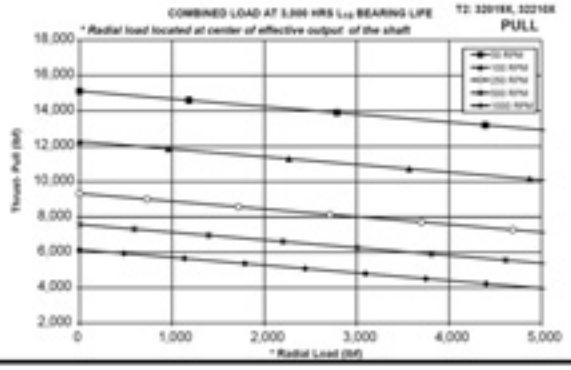
Bearing Data - Thrust Capable

BEARING LOADING THRUST CAPABLE -
The bearings in the 37 Series Thrust capable motor can accept thrust and radial load per the push/pull capacity charts to the right. Thrust loading is allowed up to the parameters indicated on the charts with shaft configurations including standard keyed and splined as well as the female shaft type shown below. For applications not requiring thrust, see the standard motor bearing charts on the opposite page.

HORSEPOWER LIMITATION -
Maximum horsepower limitation may vary with different applications. When using the 37 Series standard motor above 175HP, consult a Rineer Application Engineer.







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Model Code

M037 - A2 / A4 **-1S** **-037** **-31** **-B1** **-TBB** **-000**

- **-000** → Special Code Designator
- **-TBB** → Seal - Package Selection
- **-B1** → Bearing Package Selection
- **-31**
  - 30 = Keyed Shaft
  - 31 = Splined Shaft
  - 34 = Double Key
  - 35 = Female Key
  - 36 = Female Spline
  - 40 = Double Spline
  - 41 = Tapered Thrust
  - 42 = Keyed w/Opt
  - 43 = Splined w/Opt
  - 44 = Tapered w/Opt
  - 52 = Smooth Shaft
  - 53 = API Thread
- **-037** → Displacement Options

  SINGLE STACK
  - 012 = 12 in³ (197cc)/rev.
  - 016 = 16 in³ (262cc)/rev.
  - 020 = 20 in³ (328cc)/rev.
  - 026 = 26 in³ (426cc)/rev.
  - 032 = 32 in³ (525cc)/rev.
  - 037 = 37 in³ (606cc)/rev.

  DOUBLE STACK/4-PORT
  - 024 = 24 in³ (393cc)/rev.
  - 032 = 32 in³ (525cc)/rev.
  - 036 = 36 in³ (590cc)/rev.
  - 040 = 40 in³ (656cc)/rev.
  - 046 = 46 in³ (754cc)/rev.
  - 052 = 52 in³ (852cc)/rev.
  - 058 = 58 in³ (951cc)/rev.
  - 064 = 64 in³ (1049cc)/rev.
  - 068 = 68 in³ (1115cc)/rev.
  - 069 = 69 in³ (1131cc)/rev.
  - 074 = 74 in³ (1213cc)/rev.
- **-1S** → Rotary Group Designation
  - 1S = Code 61 - Standard
  - 1L = Code 61 Low Speed
- **M037 - A2 / A4**
  - M037 = Motor Series
  - Port Options:
    - A2 = Std. 2 port w/ 4-Bolt Flange ports
    - A4 = 4-Port model w/ 4-Bolt Flange ports
    - C2 = Std. 2 port w/ O-Ring Boss ports
    - C4 = 4-Port model w/ O-Ring Boss ports

Applications

For durable hydraulic motors that meet your demands, specify Rineer.

For over 35 years, we have specialized in only one thing - engineering the right motor for your needs. Rineer delivers the performance you can count on.

Visit our website at www.rineer.com

Limited Warranty Policy

Rineer Hydraulics, Inc. warrants that, at the time of shipment to Purchaser, our product will be free of defects in the material and workmanship. The above warranty is LIMITED to defective products returned by Purchaser to Rineer Hydraulics, Inc., freight prepaid within four hundred and fifty-five (455) days from date of shipment, or one (1) year from date of first use, whichever expires first. We will repair or replace any product or part thereof which is proved to be defective in workmanship or material. There is no other warranty, expressed or implied, and in no event shall Rineer Hydraulics, Inc. be liable for consequential or special damages. Dismantling the product, operation of the product beyond the published capabilities or for purposes other than that for which the product was designed, shall void this warranty.

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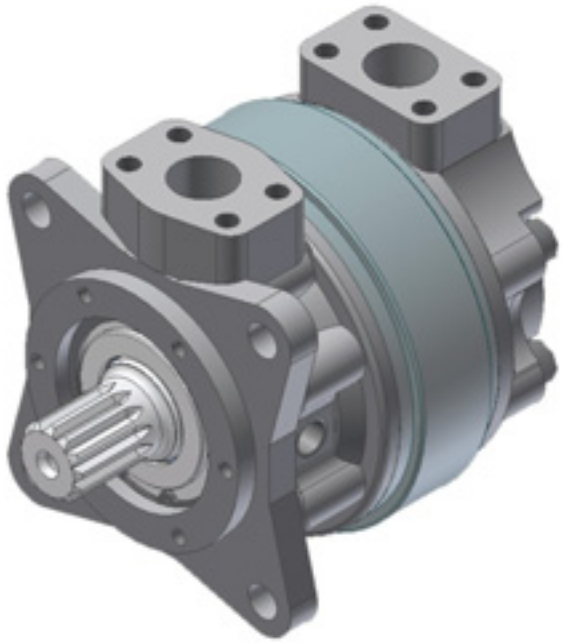
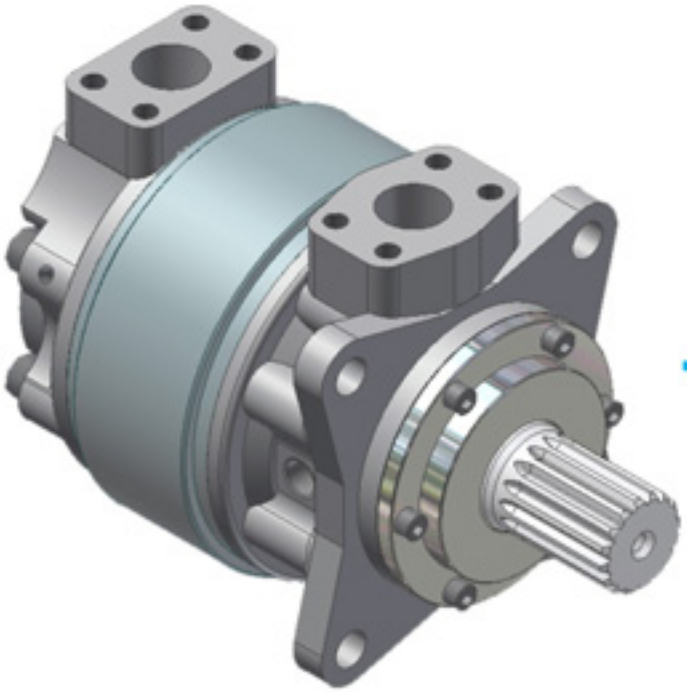
MANUFACTURER OF HYDRAULIC MOTORS
RINEER®
HYDRAULICS, INC.

Repair Manual

37 Series 57 Series



37



57

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Data Sheet RM375030 5/30/02

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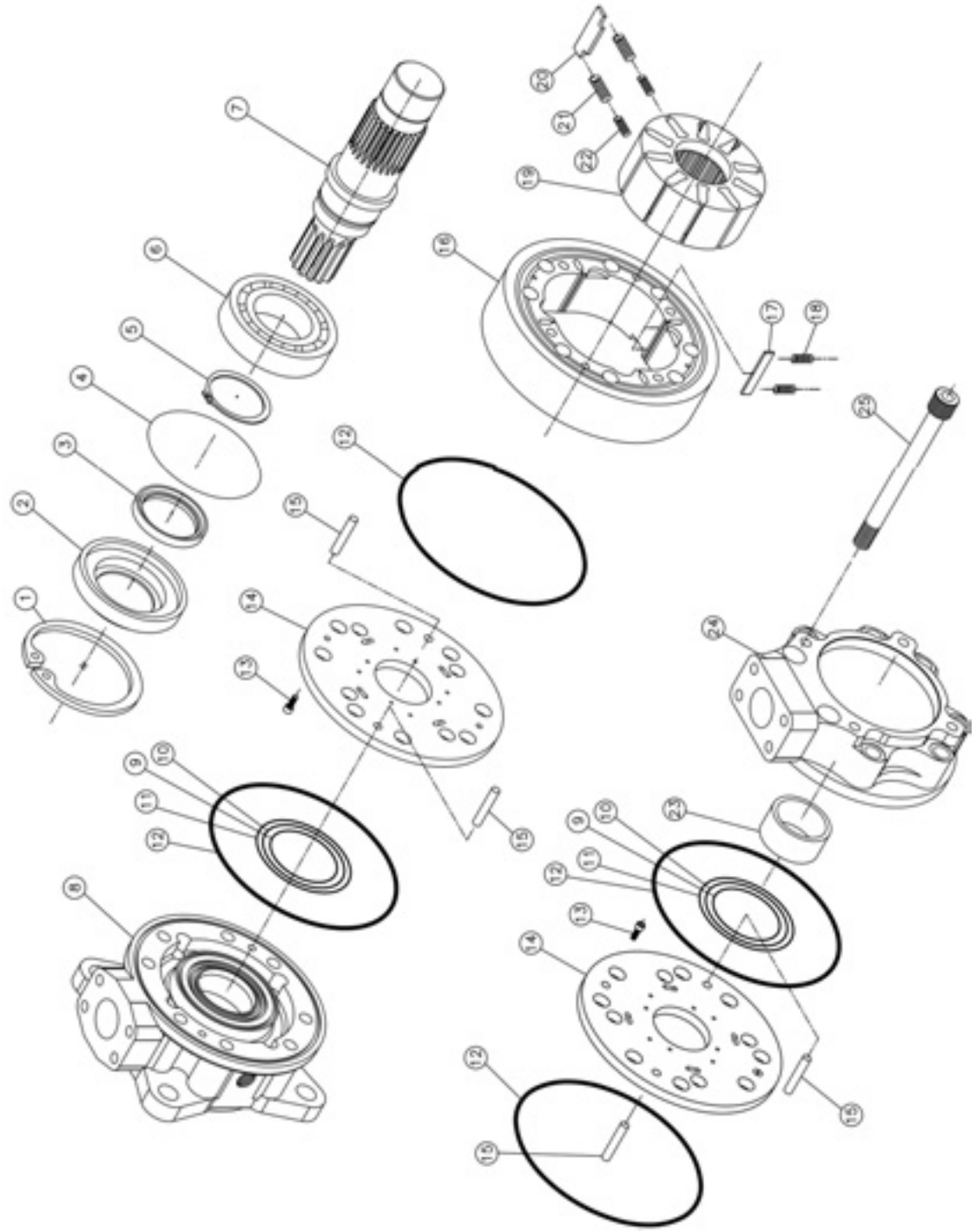
SERIES 37 EXP. VIEW, STD. "A" STYLE			
ITEM	PART NO.	DESCRIPTION	QTY
1	03701111	SEAL PLATE SNAP RING	1
2	03701152	SEAL PLATE	1
3	03701175	SEAL, SHAFT, TCN	1
4	03701114	O-RING, SEAL PLATE	1
5	03701230	SNAP RING, BEARING	1
6	03701711	BALL BEARING	1
7	03701702	SHAFT, SPLINED	1
	03701701	SHAFT, KEYED	1
8	03711123	FRONT HOUSING, A, PC	1
9	03706811	O-RING, THERMAL, INNER	2
10	03711829	O-RING, THERMAL, MIDDLE	2
11	03706810	O-RING, THERMAL, OUTER	2
12	03706610	O-RING, MAIN	4
13	91190620	PLATE SCREW	4
14	03706618	PLATE, TIMING, PC	2
15	03704431	DOWEL PIN	4
16	03704400	STATOR, GA 37	1
	03704401	STATOR, GA 32	1
	03704402	STATOR, GA 26	1
	03704403	STATOR, GA 20	1
	03704404	STATOR, GA 16	1
	03704405	STATOR, GA 12	1
17	91190410	STATOR VANE	4
18	03704420	STATOR VANE SPRING	8
19	03703000PC	ROTOR	1
	03703000PL	ROTOR	1
20	03703113PC	ROTOR VANE, B	10
	03703116PL	ROTOR VANE, L	10
21	12503320	ROTOR VANE SPRING, OUTER	20
22	12503321	ROTOR VANE SPRING, INNER	20
23	03707720	NEEDLE BEARING	1
24	03705883	REAR HOUSING, A, PC	1
25	03705901	BOLT	8



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WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

Removal of 37 Series Seal Carrier Plate

1

1) Remove snap ring.

WARNING:
Use caution when removing snap ring. If released accidentally, it can become an airborne hazard.

2

1) Pry out shaft seal plate with two screwdrivers.

2) Remove seal plate o-ring from groove in bearing bore.

NOTE:
The shaft seal on a std. motor is pressed in and can be removed in the reverse manner.

Removal of 57 Series Seal Carrier Plate

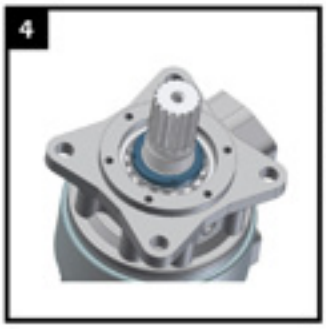
3

1) Loosen and remove 6 each 3/8-16 bolts.

2) Lift up on the seal plate. Protect the shaft seal from being cut by the keyway (keyed shaft) by placing a thin strip of metallic tape over the shaft. Smooth any burrs that may tear or snag the seal.

Shaft Disassembly

4



A 1/2-13 tapped hole is included in the end of the 37 and 57 series shafts. A slide hammer shaft puller can be attached using this tapped hole in order to remove the shaft from the motor.

5

(Remove only as necessary) Bearings from both shafts can now be removed in the following manner:

37 Series
1) Remove snap ring from shaft.
2) Press shaft out of bearing.

57 Series
1) Unfold tab on lock washer.
2) Unscrew lock nut with hook style spanner wrench.
3) Press shaft out of bearing.

Removal of Front Housing and Rotating group

6

Both the 37 and 57 motors should be positioned as shown in a suitable mount to hold the unit during main bolt removal and subsequent disassembly. To ensure proper orientation during assembly, use a laquer paint pen to mark a line down the side of the motor.

7

Loosen and remove the eight 5/8-11 main bolts. Any bolt heads showing heavy corrosion or signs of rounding of the hex form should be replaced.

8

Remove rear housing as shown. Remove o-rings from housing and dowel pins from the rotating group.

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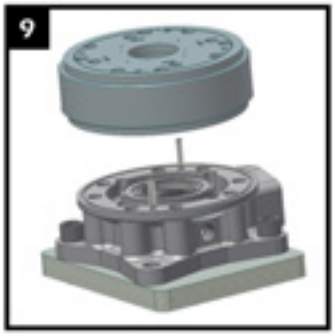
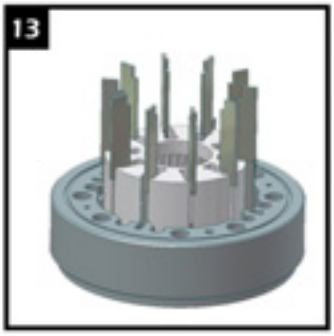
WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

9



Remove rotating group from front housing as shown. Place the rotating group on a clean surface for disassembly and inspection.
Remove dowel pins and o-rings from the housing.

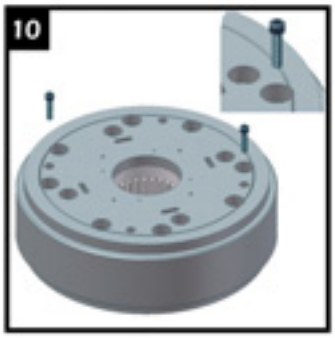
13



1) Remove the rotor.
2) Remove both the rotor and the stator vanes.
NOTE: On motors manufactured prior to 1987, rotor vane slots and rotor vanes should be numbered so that vanes can be reassembled in the same vane slot.
3) Separate parts and rinse in solvent tank.

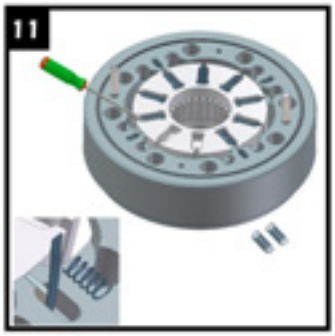
Disassembly of Rotating group

10



1) Place cartridge on any object which will hold it off the table.
2) Remove two each10-32 plate screws.
3) Remove timing plate.

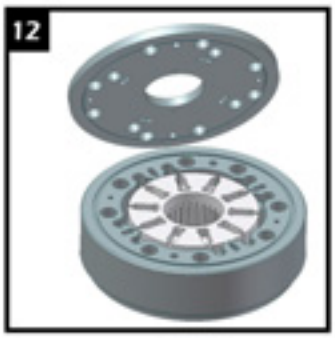
11



Using a small screwdriver or pick, remove o-ring and all rotor and stator springs.

Note:
Some 57 series rotating groups may contain additional "wave" springs in the stator vane slot (see inset).

12



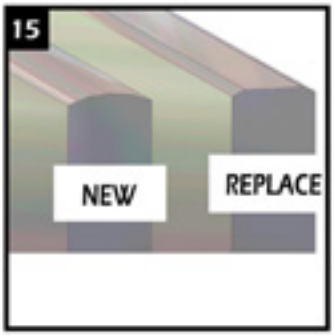
1) Replace plate on rotor/stator cartridge.
2) Turn rotor/stator cartridge over.
3) Repeat steps 10 & 11.

Inspection and Replacement of parts

14

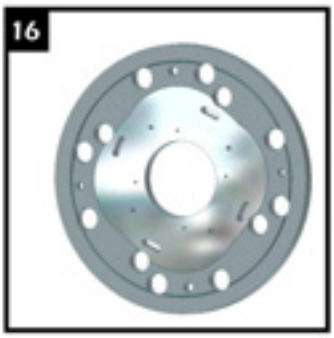
Inspect all parts and replace any parts which obviously show excessive wear or damage.
We recommend changing all springs and seals whenever the motor has been disassembled.

15



VANES:
Normal wear results in slight flattening of vane tips which does not impair motor performance. Replace vane if radius is reduced by 50%. Clearance between the rotor vane and rotor vane slot varies with the vane selection. The design allows the vane to "lean" slightly in the slot, providing the required mechanical seal.

16



PLATES:
Normal wear results in marking or polishing of the timing plate surface, which does not impair motor performance.
Replacement of the timing plate is required if any smearing, galling, or heat cracks are present.

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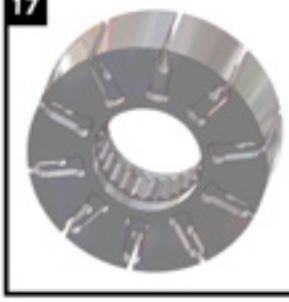
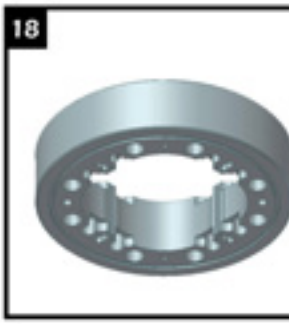
WARNING: RINEER RECOMMENDS FOLLOWING **ALL** STANDARD SHOP SAFETY PRACTICES SPECIFICALLY INCLUDING WEARING OF EYE PROTECTION.

17



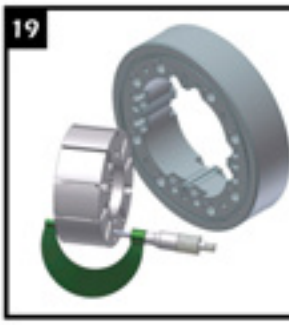
ROTOR: Normal wear results in polishing of rotor faces which does not impair motor performance. Examine the rotor vane slots closely. Polishing down in the slots is normal, but if there is any indication of a "pocket" forming in the wall of the slot, the rotor should be replaced.

18



STATOR: Normal wear results in polishing of cam form which does not impair motor performance. Noticeable wear may be apparent along the corner of one side of the stator vane slot. This does not necessarily require replacement of the stator, but may slightly affect volumetric efficiency.

19



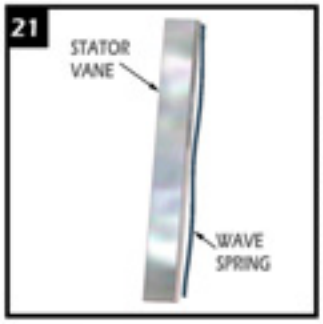
Measure the rotor and stator length to the fourth decimal point and supply measurement when ordering rotor, stator, or vanes.

Assembly of Rotor / Stator Cartridge

20

1) Reverse the procedures in steps 13, 12, 11, and 10. Before installing timing plate onto completed sides of rotating group, pour a small amount of hydraulic oil onto rotor surface.
2) **NOTE:** Make sure that the radiused edge of each stator vane points to the rotor and the radiused edge of each rotor vane points to the stator.
3) **NOTE:** Make sure springs are seated in the bottom of the spring pocket in both the rotor and stator.
NOTE: Do not allow the coil of any spring catch on the edge of the rotor or stator vanes.

21



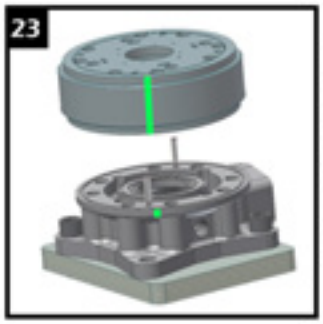
Wave springs in the 57 series do not need to be replaced. Certain model codes do not contain wave springs, while other model codes may contain two per vane. Place the stator vane and wave spring in the stator vane slot simultaneously. Note orientation as shown.
Do not let the coil spring loop catch between the wave spring and vane.

Assembly of Motor

22

Using a medium India honing stone, lightly dress all machine surfaces to remove any raised metal or burrs. Pay particular attention to the front and rear housing machined faces. Rough handling can cause raised surfaces near the O.D. of the housings which will prevent proper seating of the timing plates to the machined surfaces of the housing. NOTE: The pedestal surface (center of the front and rear housing containing two or three o-rings) is .002-.003 **below** the outer machined surface. Dress these surfaces independently.

23



Assemble the motor by reversing the previous procedures. Insure that the main body and pedestal o-rings are held in place by using an adequate amount of grease in the o-ring grooves. Line up the housings and rotating group with the paint line made on the motor in step 6.

24

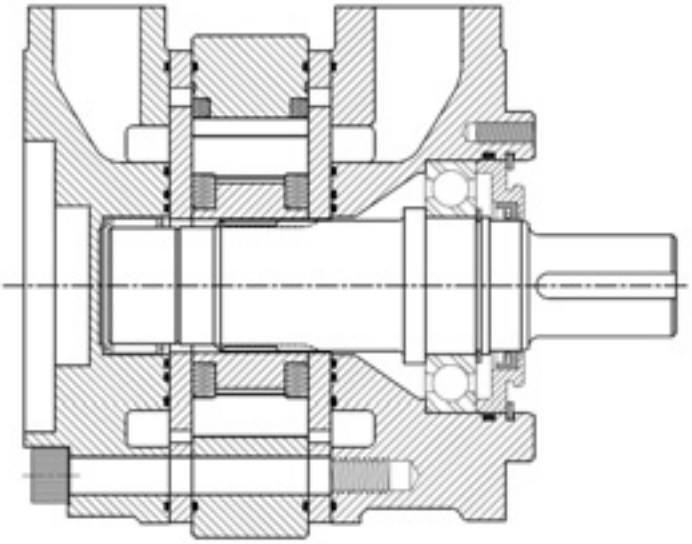
Grease the threads of the 5/8-11 bolts and insert into motor. Set torque wrench to 200 ft. lbs. and tighten in a star pattern. Install shaft, seal plate and snap ring in reverse order of previous procedures. Rotate shaft to insure no binding is present.

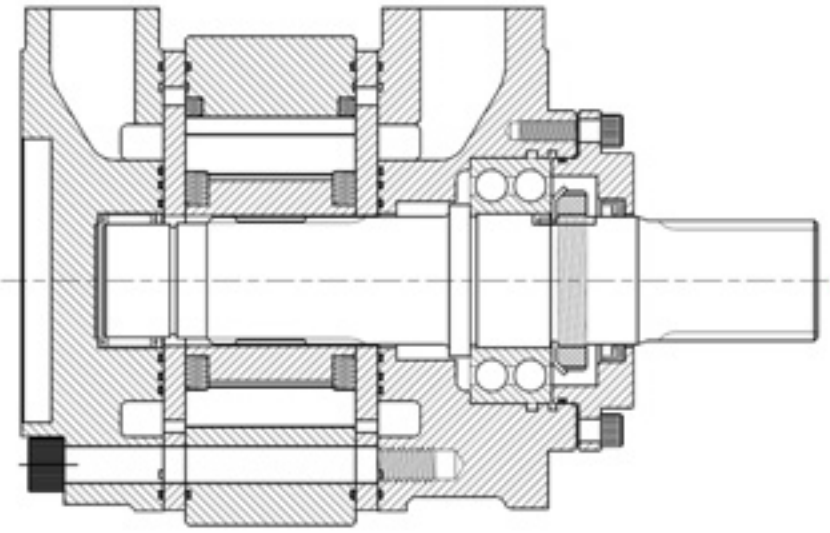
Information:

Bolt Torque -
Main Bolts (5/8-11): 200 ft. lbs.
Seal Plate (3/8-16)
(57 series only): 45 ft. lbs.
Grease used for bolt threads and o-ring retention:
Pennzoil 707L RED
Shaft seal assembly lube:
Mobilgrease special with Moly

Seal Kits:
Standard 37 series seal kit
#0370973
Standard 37 thru-key seal kit
#0370962
Standard 57 series seal kit
#0370963

37





57

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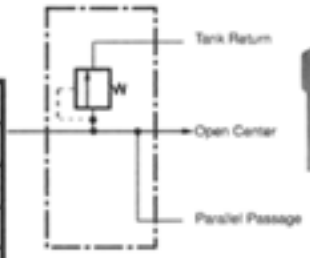
Inlets (2500 psi)

End Inlet

Code	End Port	Top Port
DVA35-A440	1" NPT	1" NPT
DVA35-A880	SAE-16	SAE-16
DVA35-A980	SAE-20	SAE-16
DVA35-A000	NON-PORTED HOUSING	

NOTE: Inlets are machined for a main R/V or R/V plug and are furnished with plastic closures. See Section G, Page 32 for inlet port plugs



Schematic shown with main R/V

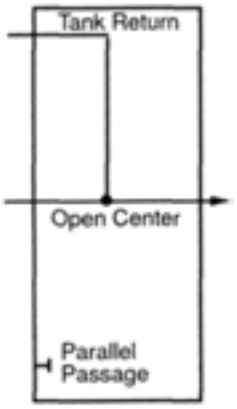
Note: For inlets with solenoid section pilot supply machining, see DVG35 inlet section E1

Outlets

Tank Return Type

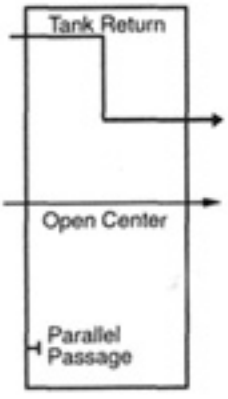
Code	End Port	Top Port
DVA35-TR55	1 1/4" NPT	1 1/4" NPT
DVA35-TR99	SAE-20	SAE-20
DVA35-TR00	NON-PORTED HOUSING	

NOTE: See Section G, Page 32 for Port Plugs



Pressure Beyond Type

	End Port LP	End Port HP	Top Port LP	Top Port HP
DVA35-PB55	1 1/4" NPT	1 1/4" NPT	1 1/4" NPT	1 1/4" NPT
DVA35-PB90	SAE-20	SAE-20		
DVA35-PB09			SAE-20	SAE-20
DVA35-PB00	NON-PORTED HOUSING			



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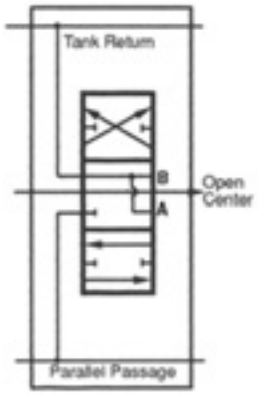
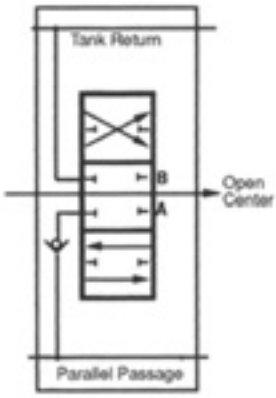


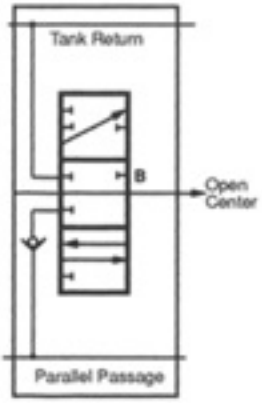
MA8

Double-Acting Section
4-Way, 3-Position, Float in Neutral
Motor Spool



DA8

Double-Acting Section
4-Way, 3-Position, Hold in Neutral
Cylinder Spool



SA8

Single-Acting Section
3-Way, 3-Position, Hold in Neutral
Cylinder Spool

Adjustable Relief Valve Cartridges

For Inlets and Mid-section Inlets

Code	Description
DVA35-MRV-1	Main R/V pressure range 800-2000 psi. Factory set @ 1500 psi @ 50 gpm
DVA35-MRV-2	Main R/V pressure range 2001-2500 psi. Factory set @2500 psi @ 50 gpm.
DVA35-MRVP	Main relief valve plug

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Lo-Boy Work Sections -- Parallel Circuits

Code	4-Way 3-Position Hold In Neutral	3-Way 3-Position Hold In Neutral	4-Way 3-Position Float In Neutral	4-Way 4-Position Float Position Detented	Port Size	Work Port NOT Machined	Spring Return	3-Position Detent	Metered Hydraulic Remote Control	Solenoid Operated	Air Shift		
DVA35-DAO	•					•	•						
DVA35-DA4	•				1"NPT		•						
DVA35-DA8	•				SAE-16		•						
DVA35-SAO		•				•	•						
DVA35-SA4		•			1" NPT		•						
DVA35-SA8		•			SAE-16		•						
DVA35-MA0			•			•	•						
DVA35-MA4			•		1" NPT		•						
DVA35-MA8			•		SAE-16		•						
DVA35-DK8-12V	•				SAE-16					• 12 VDC			
DVA35-DK8-24V	•				SAE-16					• 24 VDC			
DVA35-DX4	•				1" NPT				•				
DVA35-DX8	•				SAE-16				•				
DVA35-DV4	•				1" NPT						•		
DVA35-DV8	•				SAE-16						•		
DVA35-MX4			•		1" NPT				•				
DVA35-MX8			•		SAE-16				•				
DVA35-DB4	•				1" NPT			•					
DVA35-DB8	•				SAE-16			•					
DVA35-SB4		•			1"NPT			•					

Note: See Section G, Page 33 for section seal kits.
Codes outside of the shaded area may require increased lead time.
Most codes outside the shaded area can be made from codes inside the area and kits on page 33.
Solenoids are furnished with spade connectors
Machining instructions for standard housings are included in solenoid kits.

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Brief Circuit Descriptions

Series Circuit

Available in DVA20 sections only.

If a machine's work cycle requires simultaneous as well as separate operation of individual hydraulic work functions, a series circuit is right for the job.

As with the other circuits, the oil flows through the open center when all spools are in neutral. There is no parallel passage in standard series sections because they feed directly from the open center passage. If more than one spool is operated, pump flow goes first to the section closest to the inlet. Return flow from the first section is fed back into the open center for use by downstream sections.

Downstream sections can be series, parallel or tandem and will operate in series with the upstream section.

In series circuits, operating pressure is cumulative. Therefore, the sum of the pressures in the circuits can not exceed the circuit or main relief valve setting.

Parallel Circuits

Parallel circuits are the most common on mobile equipment because more than one function can be operated simultaneously and at random. If two or more functions are fully operated at the same time, the one with the lightest load will assert priority because the fluid will take the path of least resistance. However, the operater can divide the flow between functions by metering the spools.

Movement of the spool meters or shuts off the flow of oil thru the open center passage and pressurizes the parallel passage. Oil is then available, at the operator's discretion, to all work ports connected to the parallel passage.

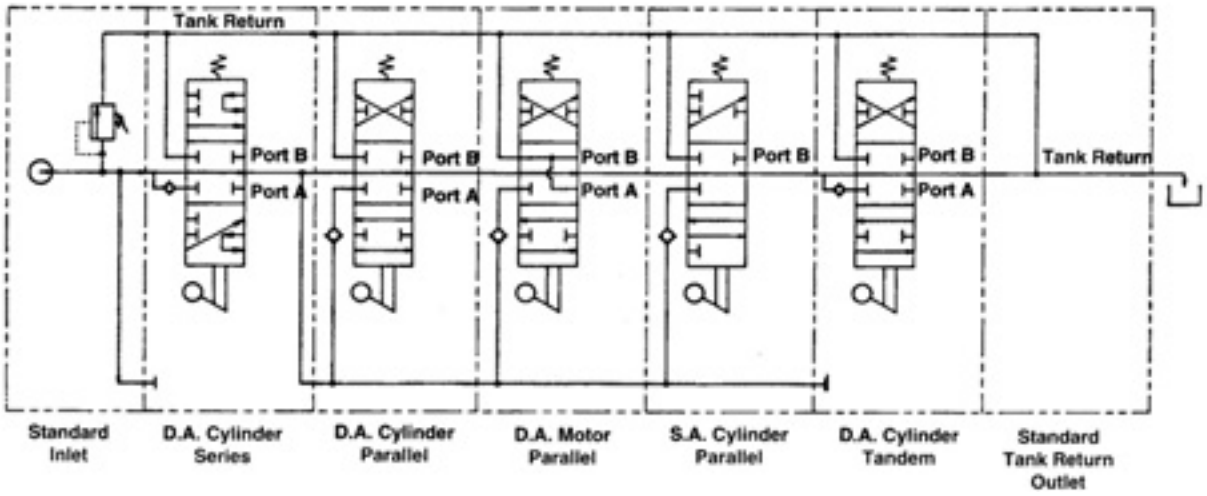
Tandem Circuits

(Not available in the program)

Tandem circuits are sometimes called priority or standard circuits by other manufacturers. Tandem sections feed from the open center passage like series sections but the return flow is directed to the tank return passage and is not available downstream.

If a tandem section is followed by a series or tandem section, operating the tandem section nearest the inlet will assert priority and downstream sections will not function.

Typical Work Section Schematics



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VA™/VG™ Valve Service Instructions

INTRODUCTION

This manual has been prepared to assist you in the proper maintenance of the VA20™/VA35™ and VG20™/VG35™/VG80™ directional control valves. Before any work is done, we suggest that you read the assembly and disassembly instructions completely.

The first rule of good maintenance is cleanliness, which includes a clean environment. MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA. Dirt is the natural enemy of any hydraulic system.

GENERAL INFORMATION

The VA and VG model valves are updated versions of our proven A20™ and A35™ units. The VG models are cast from compacted graphite, a high strength iron alloy, which allows the valve to be rated to 3500 psi. VA models are cast from gray iron and are rated at 2500 psi. These open-center, directional-control valves are available in parallel, tandem, and series circuitry. As needed, the sectional, stack-type construction provides flexibility for the addition of subtraction of work sections to an existing valve bank. This design also permits the combination of parallel, tandem, and series circuitry in a single bank. The internal coring of each valve section determines its circuitry and the number of gasket seals required.

All sections with optional features, such as port relief valves, crossover relief valves, and anti-cavitation checks, are dimensionally larger when measured from the top of the port to the bottom of the housing. These are referred to as “hi-boy” sections. Those without work-port options can use the low-profile castings, which are called “lo-boy” sections.

REPLACEMENT PARTS

The illustrations and instructions in this manual apply only to the VA/VG series assemblies, subassemblies, and components. All valve components, except for spools and housings, are available as replacement parts or subassemblies. Spools are hone-fitted to their individual housings, so damage to either of these components means the entire section must be replaced.

We recommend that you use only genuine VA/VG series replacement parts in your service program. Manufactured to the same exacting tolerances and quality controls as the original equipment, genuine VA/VG replacement parts may help prevent premature, component failure and costly downtime. Service parts and assemblies are available through your original equipment dealer or any authorized distributor.

MAINTENANCE

Valves are often used in hazardous environments. Inspect them frequently for damage due to improper use, corrosion or normal wear. If needed, repairs should be made immediately.

Always refer to the machine manual for the proper procedure to remove the valve from the machine.

Remove the valve bank from the equipment, disconnecting all hoses, fittings, control handles and linkage connectors that might be attached to the valve. Plug all ports and thoroughly clean the exterior of the valve bank, then the port plugs can be removed.

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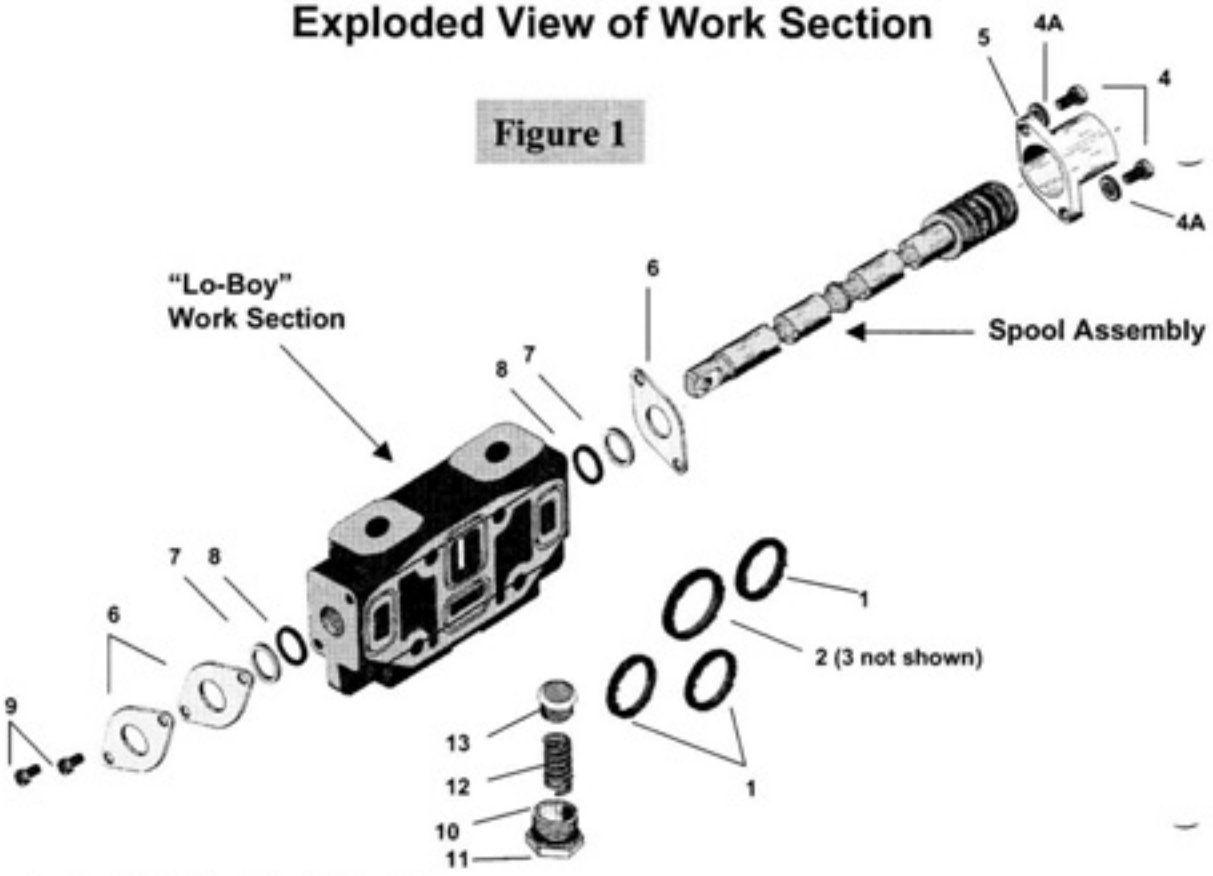
Exploded View of Work Section

Figure 1



Parts List For Work Section

Item	Description	Qty.	VA/VG20 Part No.	VA/VG35 Part No.	VG80 Part No.
Parallel Section Seals* See Figure 1					
1.	Square Seals	3	391-2881-206	391-2881-200	391-2881-433
2.	Square Seal	1	391-2881-200	391-2881-403	391-2881-670
Series Section Seals					
1.	Square Seals	2	391-2881-206	391-2881-200	.....
3.	Square Seal	1	391-2881-627	391-2881-628	.....
Parallel and Series Section Component Parts. See Figure 1					
4.	Back Cap Screws	2	391-1433-020	391-1433-009	(4) 391-1402-068
4A.	Lock washers	8	.....	.....	391-3783-039
5.	Back Cap	1	341-6000-100	342-6000-100	341-0585-099
6.	Retainer Plates	3	391-2183-001	391-2183-005	391-2183-157
7.	Back up Rings	2	391-2681-378	391-2681-426	391-2681-285
8.	Spool Seals	2	391-1985-014	391-2887-212	391-2881-096
9.	Retainer Plate Screws	2	391-1433-015	391-1433-002	(4) 391-1402-015
10.	Check Valve Cap	1	391-0581-044	391-0581-044	391-0585-099
	Or Valve Cap (F.I.N.)	1	391-2281-015	391-2281-015	.....
11.	O Ring Seal **	1	391-2881-204	391-2881-204	391-2881-249
12.	Check Spring **	1	391-3581-713	391-3581-713	391-3581-778
13.	Check Valve Poppet **	1	391-2481-069	391-2481-069	391-2383-091

*Parallel Sealing Face includes inlets and mid-inlets.
**Not required in Float-in-neutral Sections.

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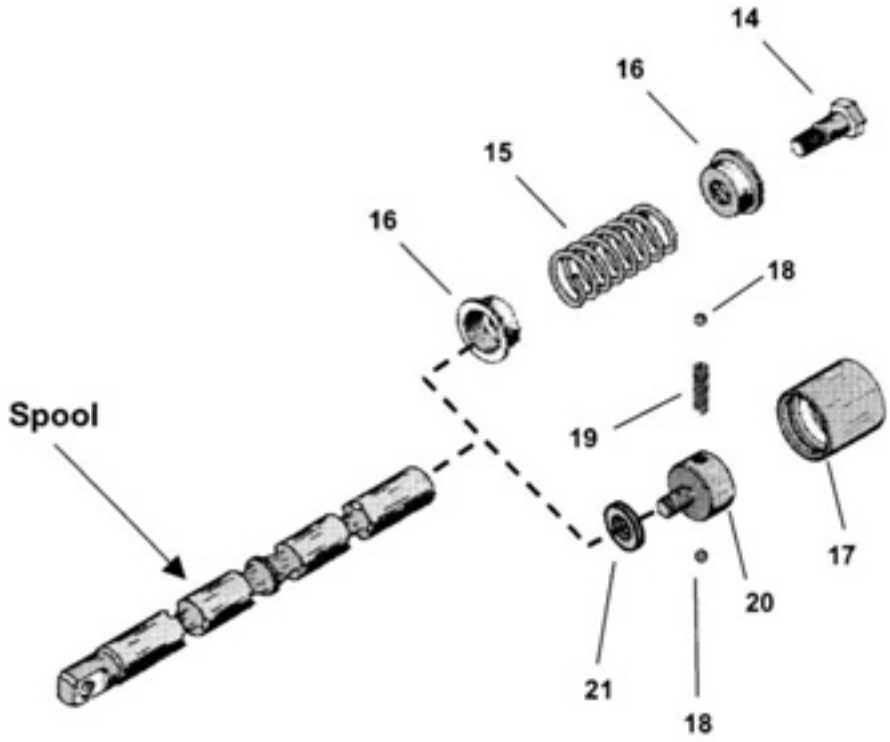
Figure 2



Spring Centered and Detent Spool Operators. See Figure 2

14.Stripper Bolt	1	391-1432-022	391-1432-021	391-1402-452
15.Centering Spring	1	391-3581-608	391-3581-633	391-3581-330
16.Spring Guides	2	391-1642-045	391-1642-013	391-1642-161
17.Detent Sleeve	1	391-3283-015	391-3283-008	391-3384-310
18.Detent Balls	2	391-0282-010	391-0282-009	391-0282-011
19.Detent Spring	1	391-3581-130	391-3581-015	391-3581-316
20.Detent Poppet Retainer	1	391-2583-008	391-2583-006	391-3384-311
21.Detent Spacer	1	.....	.....	391-3782-208

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Valve Disassembly Instructions

Reference exploded view and parts list on page 2 and 3 for work section detail.

Step 1 - Valve Bank

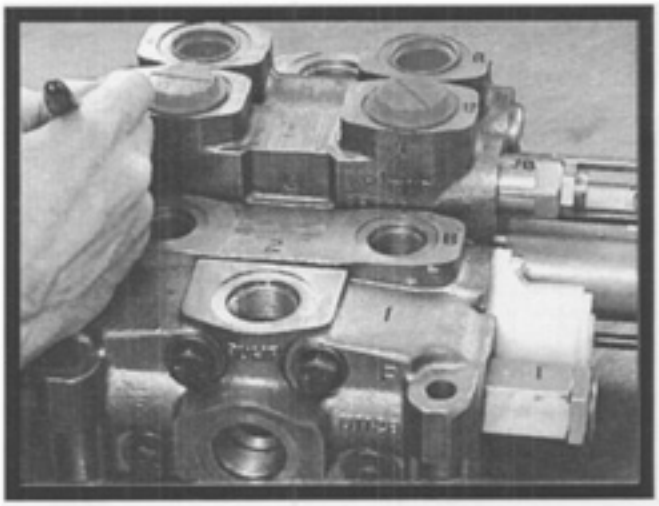
This step is the most critical in the disassembly procedure. It should be followed closely to ensure that the valve bank is properly reassembled after repairs have been made.

With a waterproof, quick-drying marker, mark each casting with a sequential number. Start by marking the inlet casting with the #1 and finish by marking the outlet with the highest number.

Next, mark the port boss closest to the back cap on each work section with a “B” (for back cap end).

Then, mark the port boss closest to the spool clevis on each work section with a “C” (for clevis end).

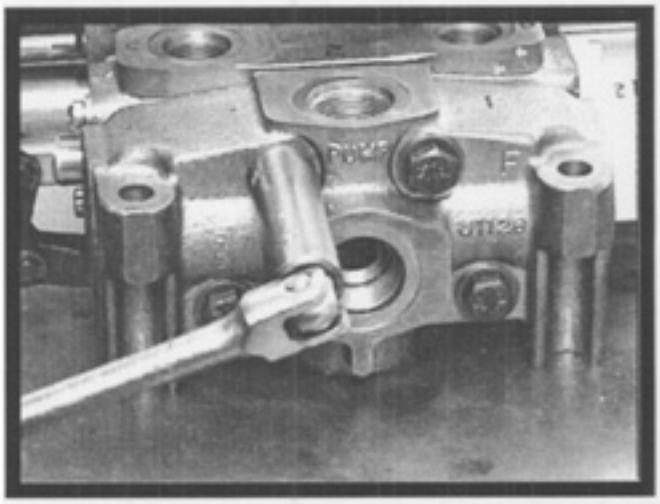
Finally, if relief valves are removed from the valve bank they must be marked with the corresponding number of the casting and port location (B or C) from which they were removed. Inlet and mid-inlet relief valves are marked with a casting number only.



Step 2 - Tie Bolts

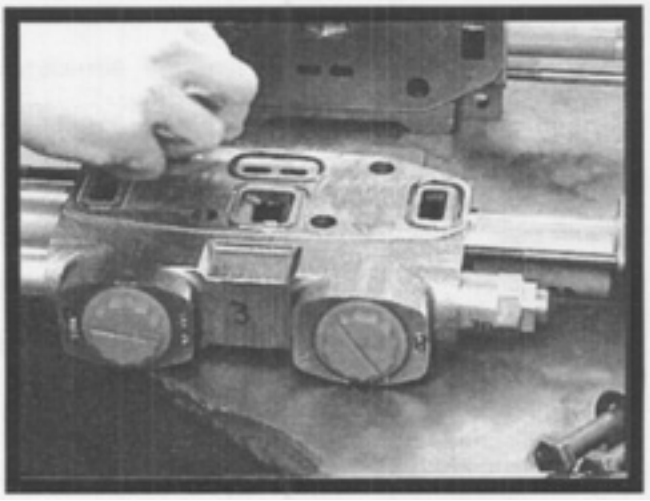
Remove the four, tie bolts that hold the bank together and separate the sections.

NOTE: VA valve tie bolts thread into the outlet casting. VG valve tie bolts pass through the entire bank, requiring washers and hex nuts to be fastened at both ends of the bolt.



Step 3 - Section Seals

The inlet, mid-inlet and each parallel work section have four, section seals, (Fig. 1, items 1 & 2) on the downstream, mating face. Series work sections and the VA/VG35 split flow mid inlets have three section seals on the downstream mating face, (Fig. 1, items 1 & 3.) These section seals should be removed and discarded.



REMINDER: ALL WORK MUST BE PERFORMED IN A CLEAN AREA.

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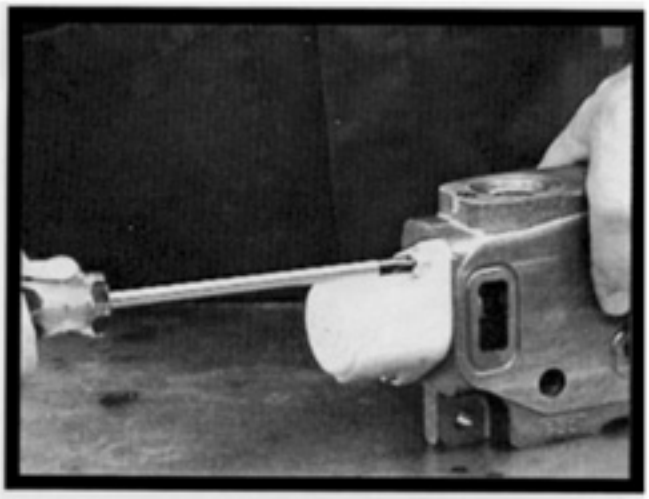
Valve Disassembly Instructions



Step 4 - Valve Back Cap

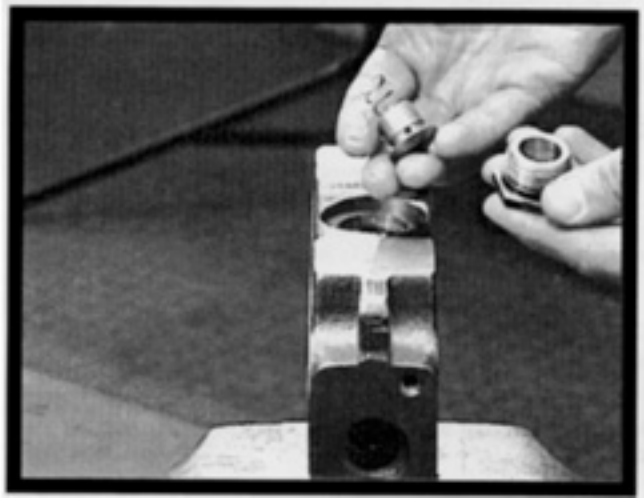
Using a large, Phillips-head screwdriver, remove the two, cap screws (Fig. 1, item 4) which fasten the back cap to the work section. Lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the back cap (Fig. 1, item 5).

Step 5 - Control Spool and Seals

Grasp the spring end of the spool with a clean, lint-free cloth and pull the spool out of the housing using a twisting motion. Generally, the rear, retainer plate (Fig. 1, item 6) back-up ring (Fig. 1, item 7) and spool seal (Fig. 1, item 8) will come out with the spool.

CAUTION: For detented spool models, be careful not to remove the detent poppet sleeve (Fig. 2, item 17) unless it is to be serviced.

Using a large, Phillips-head screwdriver, remove the two, retainer-plate screws (Fig. 1, item 9) from the spool clevis end of the work section. Lightly tap the end of the screwdriver handle with a hammer to break the adhesive. Remove the two, retainer plates (Fig. 1, item 6) the back-up ring (Fig. 1, item 7) and the spool seal (Fig. 1, item 8). Tag or mark with the appropriate, work section identification number. (See Step 1.) Spool seals (Fig. 1, item 8) and back-up rings (Fig. 1, item 7) should be discarded.



Step 6 - Transition Check

The transition check is located in the bottom center of the work section housing. Carefully clamp the work section in a vise with ports down. Do not clamp on the machined surface. Remove the check-valve cap (Fig. 1, item 10) and its O-ring seal (Fig. 1, item 11). Discard the seal. Remove the check spring (Fig. 1, item 12,) and the check-valve poppet (Fig. 1, item 13).

NOTE: Only cylinder work sections (ports blocked in neutral) have a transition check. Motor sections have only a cap plug.

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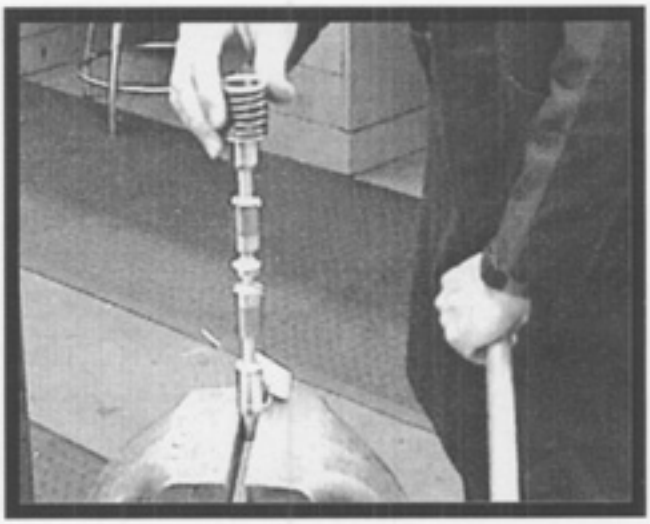
Valve Disassembly Instructions

Spool Disassembly

Spring Centered Spool

The spring assembly should not be removed from the spool unless these parts need to be replaced. Once the spool is free of the work section housing, it must be handled carefully to avoid damage. Place the spool vertically in a soft-jawed vise, clamping on the flat, spool clevis, and remove the stripper bolt (Fig. 1, item 14) with a wrench.



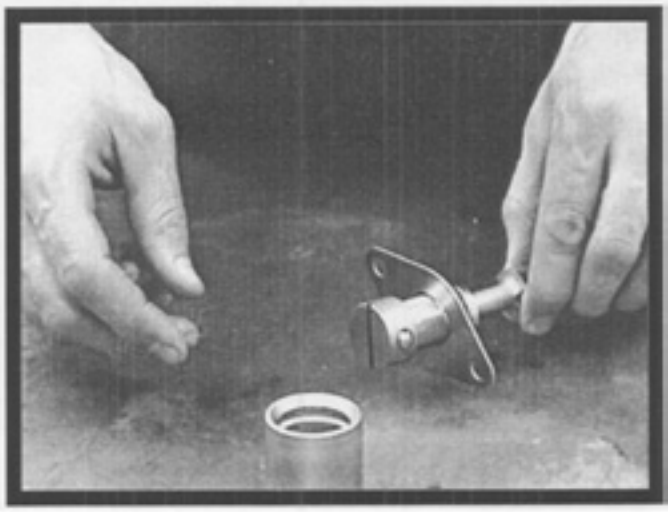
Lightly tap the stripper bolt with a hammer and a punch to help break the adhesive. Cautious application of heat may be required to free the stripper bolt, since an anaerobic thread adhesive was used during its assembly.

CAUTION: Too much heat may distort the spool.

As the stripper-bolt threads disengage, the spring (Fig. 2, item 15) and spring guides (Fig. 2, item 16) will release abruptly from the spool.

Detent Spool

The detent assembly should not be removed from the spool unless these parts need to be replaced. Wrap the detent sleeve (Fig. 2, item 17) with a clean, lint-free cloth. Grip the cloth-covered sleeve and pull firmly. As the sleeve moves backwards, the detent balls (Fig. 2, item 18) and the detent spring (Fig. 2, item 19) will release abruptly. The cloth should capture these parts and prevent their loss.



Next, clamp the spool in a soft-jawed vise and remove the detent poppet retainer (Fig. 2, item 20). Place an undersized bar through the detent ball bore to serve as a wrench. Lightly tap the detent poppet retainer with a hammer and a punch to help break the adhesive. Cautious application of heat may be required again, since an anaerobic adhesive was also used in the detent retainer assembly.

CAUTION: Too much heat may distort the spool!

CLEANING, INSPECTION, AND REPAIR

1. Inspect the spool bore, transition check seat and spool from each section for deep scratches, gouges or excessive wear. If any of these conditions exist, replace the section. Minor, surface damage on the control spool and check poppet can be carefully polished away with a very fine, crocus cloth.

2. Examine the machined surfaces of the valve housing for nicks and burrs that could cause leakage between sections. Lightly stone these surfaces to remove any rough spots.

CAUTION: A shallow-milled relief area extends across the O-ring face of the valve housing. This should not be stoned or ground off!

3. Wash all parts thoroughly in a cleaning solvent and blow dry before beginning reassembly. Pay special attention to the number and letters marked on the parts in Step 1. If any marks are removed during cleaning, re-mark immediately.

4. Clean adhesive from threads of spool, stripper bolt, housing, cap screws and hex nut with Loctite™ Chisel Gasket Remover.

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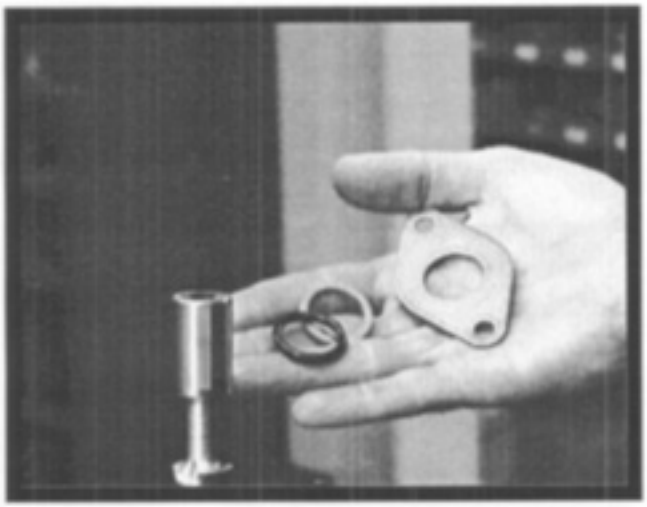
Valve Assembly Instructions

Preparation of Parts

Spray the threads of the new stripper bolt (Fig. 2, item 14) tapped-threaded spool end, all screws and screw holes on both ends of the housing with LOCQUIC Primer Grade NF™ and let dry.

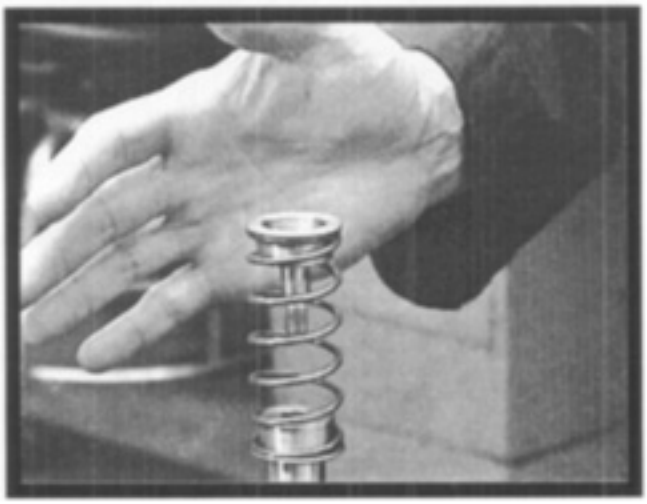
CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or product malfunction. Product should be thoroughly tested to ensure proper operation before the valve is placed back into service.

Spring Center Spool Assembly



Step 1 - Spool Assembly-Spring Centered

Clamp the flat, clevis end of the control spool in a soft jawed vise. Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the end of the spool away from the clevis. Slide on the back-up ring (Fig. 1, item 7) and retainer plate (Fig. 1, item 6). Position these items onto the spool, so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches.



Step 2 - Attach Spring Guides and Spring

Apply 2 - 3 drops of Loctite 262™ or equivalent anaerobic adhesive near the middle of the female threads in the spool. Assemble the spring guides (Fig. 2, item 16) centering spring (Fig. 2, item 15) and stripper bolt (Fig.2, item 14,) onto the spool (Reverse of Step 7). Torque the stripper bolt to 175 in. lbs. +/-4 in. lbs.

CAUTION: Care must be taken to ensure that the spring retainer is not pinched under the shoulder bolt during assembly. This can result in burrs that may cause spool binding. Check for binding by compressing the spring and guides or by rotating the spring guide nearest the housing.

CAUTION: Follow the adhesive manufacturer's instructions for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure!

Lightly coat the centering spring with high- temperature grease to prevent rusting. Set the spool assembly aside and let it cure for a minimum of 1 hour. After curing, test the stripper bolt to make certain it can withstand 125 in. lbs. of breakaway torque.

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Valve Assembly Instructions

Detent Spool Assembly

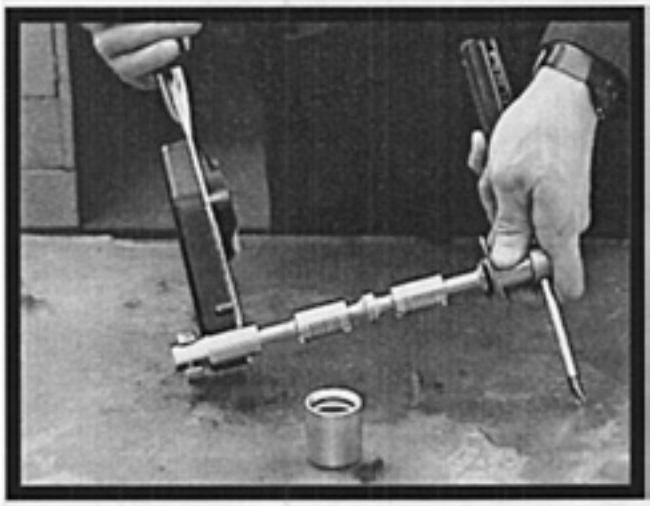
Step 1 - Spool Assembly-Detent

Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the spool. Slide the back-up ring (Fig. 1, item 7) and one, retainer plate (Fig. 1 item 6) onto the spool. Position these items onto the spool, so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches. Apply 2 - 3 drops of Loctite 262™ or an equivalent, anaerobic adhesive near the middle of the female threads in the spool.

CAUTION: Follow the adhesive manufacturer's instructions for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure.

Step 2 - Spool Assembly-Detent

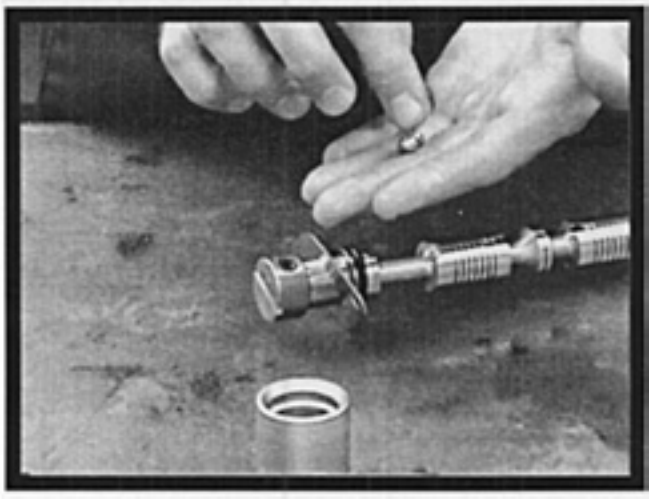
Thread the detent ball retainer (Fig. 2, item 20) into the spool end. Torque the detent ball retainer to 175 in. lbs. +/-4 in. lbs.. This can be accomplished by using a crows-foot socket on the flats of the clevis, and holding the spool by inserting a round, steel rod or screwdriver through the hole in the ball retainer.



Step 3 - Detent Balls and Spring

Next, lightly coat the detent balls (Fig. 2, item 18) detent spring (Fig. 2, item 19) and entire inside diameter of the detent sleeve (Fig. 2, item 17) with high-temperature grease.

Insert the detent spring into the through hole in the detent ball retainer. Place the steel balls on the ends of the spring. Compress the balls and spring, then slip on the detent sleeve. (Note: The detent sleeve is not symmetrical; one end of the sleeve has a lead-in chamfer. This chamfer must face the spool clevis when assembled.) Move the detent sleeve to the neutral or middle position to prevent the subassembly from separating during subsequent steps.



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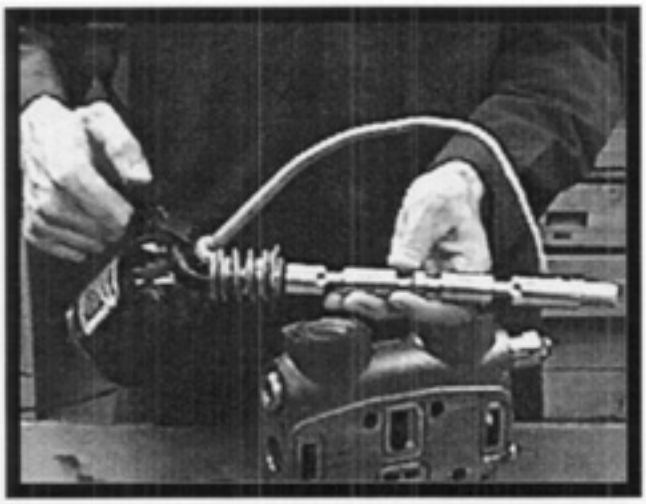
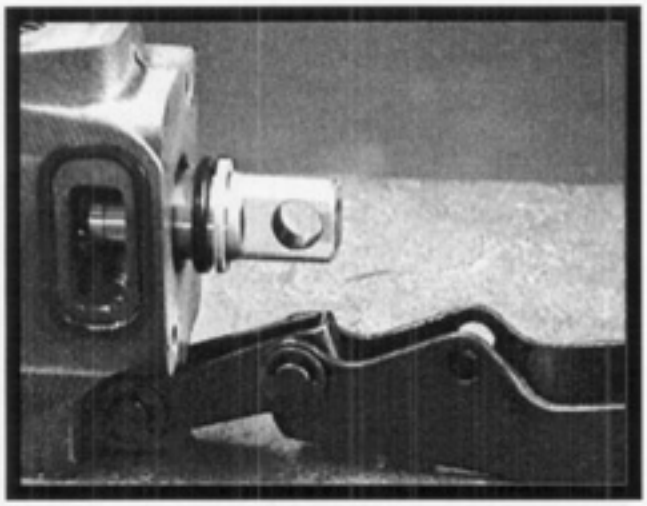
Valve Assembly Instructions



Step 1 - Spool Subassembly

Apply 2 - 3 drops of Loctite 262™ or equivalent to the fillister screw holes on both ends of the housing.

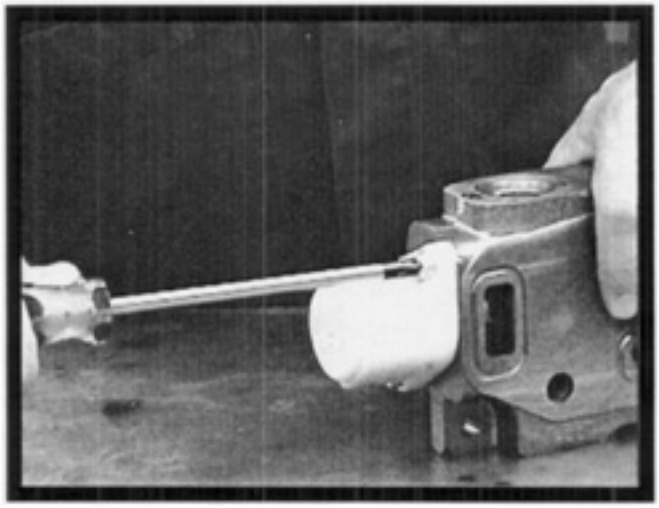
Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool assembly into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll or damage the seals. Make sure that the spool and housing are in the proper orientation (see Step 1, page 6 disassembly).



Step 2 - Spool Seal and Back up

Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the spool. Slide on the back-up ring (Fig. 1, item 7). Push both items into the counter-bore until they bottom out.

Assemble the two, front, retainer plates (Fig. 1, item 6) using the two short, fillister screws (Fig. 1, item 9). Check retainer plates for proper alignment. Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs..



Step 3 - Back cap

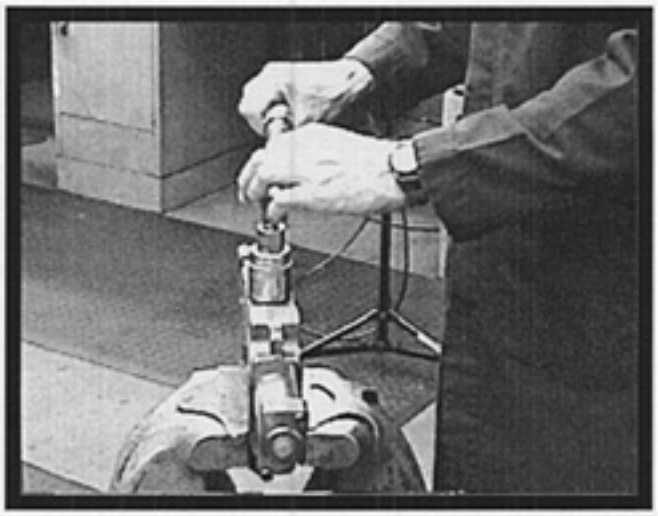
Install the back cap using the two, long, fillister screws (Fig. 1, item 4). Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs.

Caution: Excessive torque will damage the back cap ears!

Valve Assembly Instructions

Step 4 - Install Transition Check

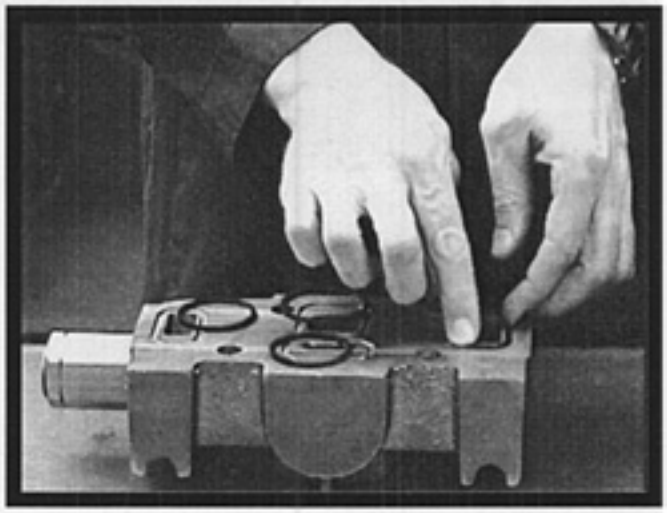
Inspect transition check components for cleanliness. Install check poppet (Fig. 1, item 13) into the transition check cavity. Align the check spring (Fig. 1, item 12) square to the poppet, then carefully place the check cap (Fig. 1, item 11) over the poppet and spring. Turning by hand, engage several threads. Tighten to a final torque of 75 ft. lbs. +/-4ft. lbs..



Step 5 - Relief Valves

Return all relief valves to their proper positions and torque to 75 ft. lbs.

Install new, section seals. Place section seals (Fig. 1, items 1 & 2, or items 1 & 3) in the proper grooves. Make certain seals stay in their grooves during assembly.



Step 6 - Install Tie Bolts

Slide the tie bolts through the inlet casting. If cap screws are used, place a washer on the cap screw prior to installation. Place the valve sections on the tie bolts in their proper sequence (see Step 1, page 4). Turning by hand, engage several threads in the outlet. If it is a VG series assembly, assemble nut and washer to either end of the stud and follow above instructions. Torque the tie bolts in a cross-corner pattern.

Tie Bolt Torque Values

VA20 - 29 ft. lbs. (348 in. lbs.)
VG20 - 42 ft. lbs. (504 in. lbs.)
VA35 - 34 ft. lbs. (408 in. lbs.)
VG35 - 75 ft. lbs. (900 in. lbs.)
VG80 - 150 ft. lbs. (1800 in. lbs.)

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Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks between sections	Pinched, blown or missing section seal	Replace section seal
	Stud fasteners not correctly torqued	Replace section seals and re-torque
	Mounting plate not level	Loosen mounting bolts and shim as required
	Contamination/burrs on seal	Clean seal groove, replace section seal
Oil leaks at either end of spool	Over-pressurized tank core	Correct high, back-pressure condition
	Worn or damaged spool seals	Replace seals and seal retainers
Spring - centered spools do not return to neutral	Broken centering spring	Replace centering spring
	Misalignment of operating linkage	Check linkage for mechanical binding
	Foreign particles in system	Clean valve and system
Load will not hold	Cylinder leaking or worn	Check cylinder - repair
	Port relief valve not holding	Remove and clean or replace
	Spool or housing scored or worn excessively	Replace section
Load drops when spool moved from neutral	Dirt or foreign particles lodged between check-valve poppet and seat	Disassemble, clean & reassemble
	Scored or sticking check-valve poppet	Replace poppet
No motion, slow, or erratic system operation	Worn pump	Check flow & pressure
	Defective cylinder or motor	Repair or replace
	Low-reservoir oil level	Add oil to specifications
	Clogged suction strainer	Clean or replace
	Suction line restricted	Check lines
	Relief valve not properly set	Check pressure setting
	Relief valve poppet or seat scored & sticking open	Replace relief valve
	Valve spool not shifted to full stroke	Check spool linkage travel

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sun hydraulics

Pilot-to-open, spring biased closed, unbalanced poppet logic element

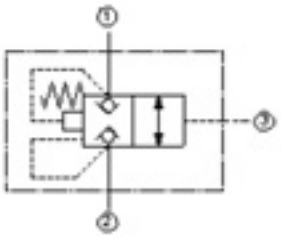
Capacity:
60 gpm (240 L/min.)

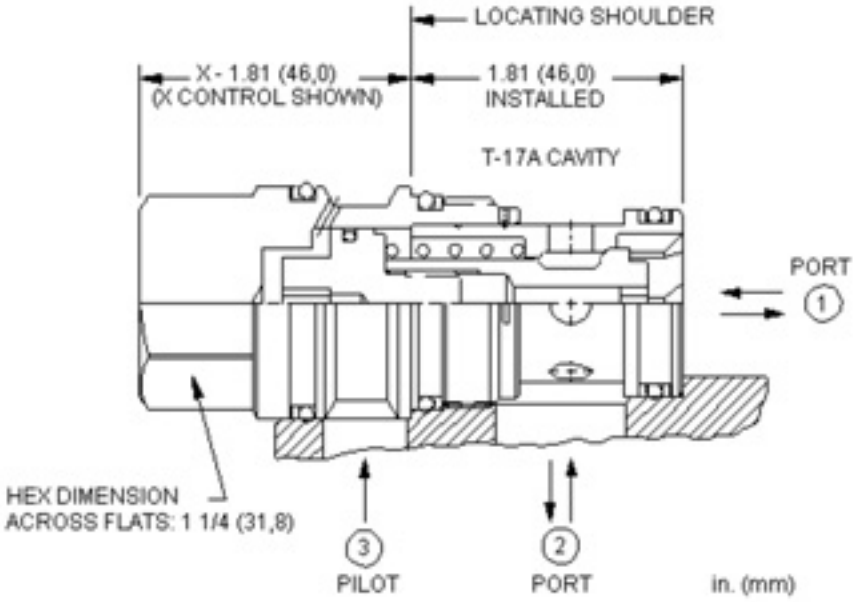
Functional Group:
Products : Cartridges : Corrosion Resistant : Logic Element : Unbalanced Poppet, Pilot-to-open, Switching Element, Spring biased closed, External Pilot Port 3 pilot source

Model:
LKHC

Product Description

These unbalanced poppet, logic valves are 2-way switching elements that are spring-biased closed. Pressure at either work port 1 or 2 will further bias the valve to the closed position while pressure at port 3 will tend to open it. The force generated at port 3 must be greater than the sum of the forces acting at port 1 and port 2 plus the spring force for the valve to open. NOTE: The pilot area (port 3) is 1.8 times the area at port 1 and 2.25 times the area at port 2.





Technical Features

- Because these valves are unbalanced, operation is pressure dependent. Opening and closing of the poppet are functions of the force balances on three areas: 1) Port 1 = 100%, Port 2 = 80%, and Port 3 = 180%.
- These valves are pressure responsive at all three ports, therefore it is essential to consider all aspects of system operation through a complete cycle. Pressure changes at any one port may cause a valve to switch from a closed to an open position, or vice versa. All possible pressure changes in the complete circuit must be considered to assure a safe, functional system design.

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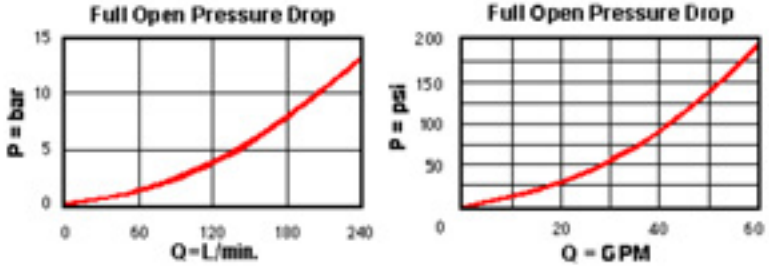
- These valves have positive seals between port 3 and port 2.
- Stainless steel cartridge options P or W are intended for use within corrosive environments with all external components manufactured in stainless steel or titanium. Internal working components remain the same as the standard valves.
- Incorporates the Sun floating style construction to eliminate the effects of internal parts binding due to excessive installation torque and/or cavity/cartridge machining variations.

Technical Data

	U.S. Units	Metric Units
Cavity	T-17A	
Capacity	60	240 L/min.
Area Ratio, A3 to A1	1.8:1	
Area Ratio, A3 to A2	2.25:1	
Maximum Operating Pressure	5000	350 bar
Maximum Valve Leakage at 110 SUS (24 cSt)	10	10 drops/min.@70 bar
Pilot Volume Displacement	.15	2.5 cc
Series (from Cavity)	3	
U.S. Patent #	4,795,129	
Valve Hex Size	1 1/4	31,8 mm
Valve Installation Torque	150 - 160	200 - 215 Nm
Seal Kits	Buna: 990-017-007	
Seal Kits	Viton: 990-017-006	



Option Selection

LKHC-X D N

Preferred Options

Control	*Cracking Pressure*	*External Material/Seal Material*
Standard Options		
X Not Adjustable		**N** Buna-N **V** Viton

DRILLING & COMPLETIONS
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sun hydraulics

Direct-acting, pressure reducing valve

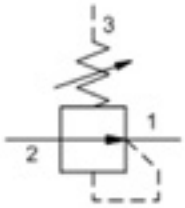
Capacity:
80 gpm (320 L/min.)

Functional Group:
Products : Cartridges : Reducing : 3 Port : Direct Acting Reducer

Model:
PRJR-LAN

Product Description

Direct-acting, pressure reducing valves reduce a high primary pressure at the inlet (port 2) to a constant reduced pressure at port 1. These valves incorporate a damped construction for stable operation allowing the use of high reduced pressure.



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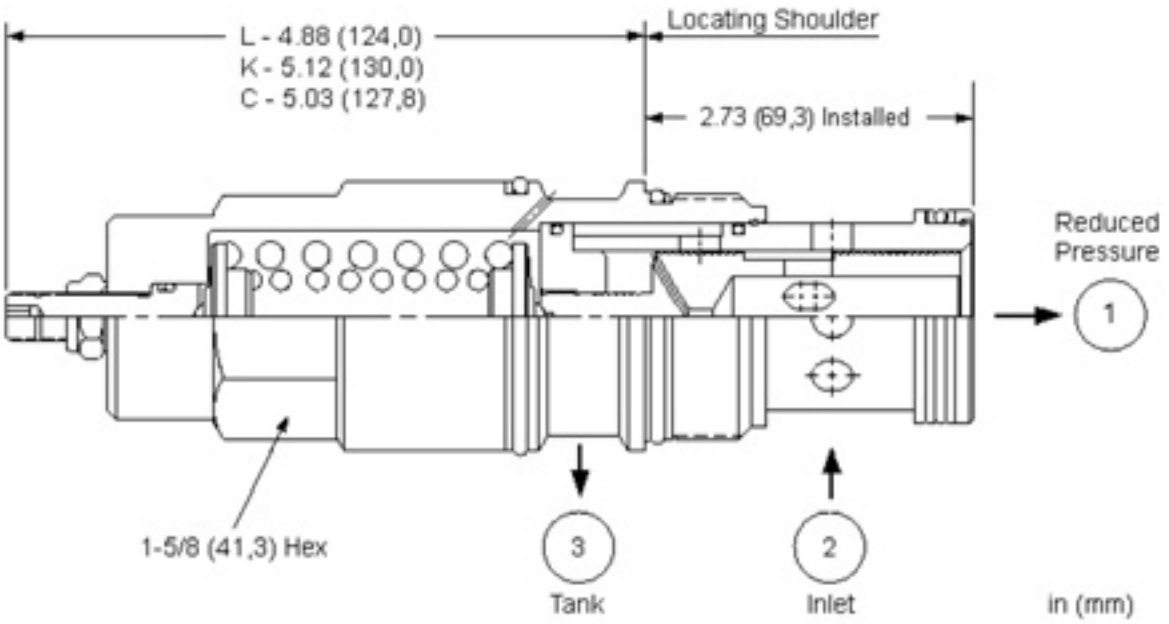

Technical Features

- Note: This valve has no relieving capability. It should not be used in a dead-headed application. If the reduced pressure side of the circuit has very low leakage the pressure may rise significantly. The pressure rise will vary from valve to valve.
- This type of valve, PR*R, is a good replacement for an LP*C as a normally open, restrictive compensating element if a higher pressure drop across an orifice is needed.
- Direct operated version offers superior dynamic response compared to equivalent pilot operated models.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi (350 bar).

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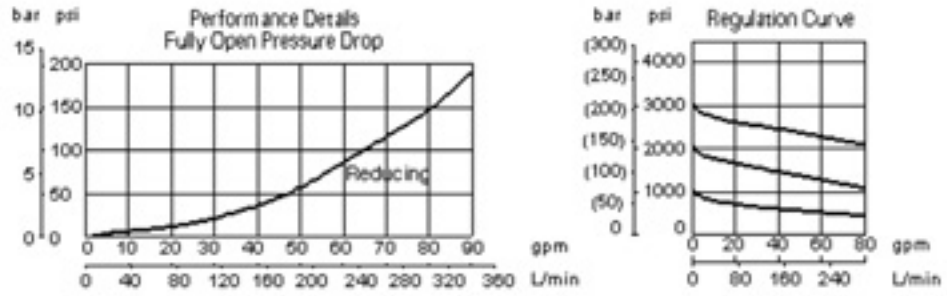
- Full reverse flow from reduced pressure (port 1) to inlet (port 2) may cause the main spool to close. If reverse free flow is required in the circuit, consider adding a separate check valve to the circuit.
- All spring ranges are tested for correct operation with 5000 psi (350 bar) inlet pressure.
- Suitable for accumulator circuits since the absence of pilot control flow results in reduced secondary circuit leakage.
- Leakage specified in Technical Data is out of port 3 with a supply pressure of 2000 psi (140 bar) and the valve set at mid range. This leakage is directly proportional to pressure differential and inversely proportional to viscosity expressed in centistokes.
- Incorporates the Sun floating style construction to minimize the possibility of internal parts binding due to excessive installation torque and/or cavity/cartridge machining variations.

Technical Data

	U.S. Units	Metric Units
Cavity	T-19A	
Capacity	80 gpm	320 L/min.
Adjustment - Number of Clockwise Turns to Increase Setting	5	
Factory Pressure Settings Established at	2 in³/min.	30 cc/min.
Maximum Operating Pressure	5000 psi	350 bar
Maximum Valve Leakage at 110 SUS (24 cSt)	5 in³/min.	80 cc/min.
Series (from Cavity)	Series 4	
Valve Hex Size	1 5/8 in.	41,3 mm
Valve Installation Torque	350 - 375 lbf ft	465 - 500 Nm
Adjustment Screw Internal Hex Size	5/32 in.	4 mm
Adjustment Locknut Hex Size	9/16 in.	15 mm
Adjustment Nut Torque	108 lbf in.	12 Nm
Seal Kits - Cartridge	Buna: 990-019-007	
Seal Kits - Cartridge	Viton: 990-019-006	
Model Weight	3.50 lb.	1.59 kg.



PRJR-LAN

Control	Adjustment Range		External Material/Seal Material
L Standard Screw Adjustment	**A** 750 - 3000 psi (50 - 210 bar), 1000 psi (70 bar)	+0.00	**N** Buna-N +0.00